SCIENCE

FRIDAY, JANUARY 10, 1896.

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MSS. intended for publication and books etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

ALASKA AS IT WAS AND IS, 1865–1895. *

IN 1864 the apparent hopelessness of the attempts to establish a workable trans-Atlantic telegraph cable led those interested in telegraphic communication with Europe to consider other means of attaining that end. It was thought that a short cable across Bering Strait might be made to work, and no doubt was entertained of the possibility of maintaining the enormously extended land lines which should connect the ends of this cable with the systems already in operation in Europe and the United States. A company was formed for this purpose, and an expedition to undertake the explorations necessary to determine the route was organized. The coöperation of the Russian and American governments was secured and the necessary funds subscribed. Searching for properly qualified explorers, the promoters of the enterprise consulted the Smithsonian Institution and were brought into communication with Robert Kennicott, of Chicago, a young and enthusiastic naturalist, who had already made some remarkable journeys in the Hudson Bay Territories in the interest of science. His explorations had taken him to the most remote of the Hudson Bay posts—Fort Yukon on the river of the same name—regardless of every kind of hardship,

* The annual presidential address, delivered before the Philosophical Society of Washington, December 6, 1895, by W. H. Dall.

privation and isolation. His ardor was so contagious that before returning to civilization he had communicated it to almost every one of the hard-headed fur traders in that remote and inhospitable region, and for years afterward bird skins, eggs, ethnological specimens, and collections in every branch of natural history, poured from the frozen north into the Smithsonian Museum by hundreds and thousands.

When Kennicott, after traveling for months on snow-shoes, sledges, or bateaux, stood at last on the steep bluff at Fort Yukon, he saw the yellow flood of the great river surging by the most remote outpost of civilization and disappearing to the westward in a vast and unknown region. An uninhabited gap of hundreds of miles lay between him and the nearest known native settlement to the west. Far in the north the midnight sun lighted up the snowy peaks of the Romanzoff mountains, whose further slope it was believed gave on the Polar sea. No one knew where the Yukon met the ocean. On most maps of that day a large river called the Colvile, found by Simpson on the Arctic coast as he journeyed toward Point Barrow, was indicated as the outlet of the Yukon watershed. South of the Romanzoff mountains for an unknown distance vast tundras, scantily wooded with larch and spruce, the breeding grounds of multitudes of water fowl, intersected by many streams, but level as a prairie, extended to the west.

The native population of this region, as far as known, had always been scanty, and an epidemic of scarlet fever, introduced some years before through contact with other tribes trading to the coast, had swept them absolutely out of existence. Not an individual was left, and the nomadic natives who reached Fort Yukon from the east and southeast hesitated to approach the hunting grounds, where the mysterious pestilence might linger still.

Obliged to terminate his explorations here, Kennicott returned, after months of weary travel, to the United States, but cherished the hope of some day penetrating the *terra incognita* on whose borders he had been obliged to pause and turn away. The dream of his life was thereafter the exploration of Russian America, the discovery of its fauna, and the determination of its relations to the fauna of Siberia and Japan. The group of young zoölogists which gathered about him at the Chicago Academy of Sciences, an institution of which Kennicott was practically the creator, was frequently roused to enthusiasm by impromptu lectures on the problems to be solved, the specimens to be collected, and the adventures to be anticipated in that virgin territory.

The need of the telegraph company for one familiar with life and conditions in the North brought him the long sought opportunity, and he undertook to lead the exploration, provided he was permitted to utilize it for science to the fullest extent commensurate with the attainment of the objects of the expedition. He stipulated that he should be permitted to select a party of six persons who should be qualified to make scientific observations and collections in the intervals of other work, but who should hold themselves ready to do any work required by the promoters of the enterprise, even to digging post-holes for the line if called upon.

His terms were accepted, and the scientific corps of the exposition organized and started for San Francisco. Here two of the members were detailed to join the party engaged in exploring the route through British Columbia; the others, of whom the speaker was one, accompanied Kennicott to the north.

In July, 1865, the exposition entered the bay of Sitka and our acquaintance with Russian America began.

Sitka was then a stockaded town of about 2,000 inhabitants, with a village of more than 1,500 Indians outside the walls. The settlement contained a Greek church, a Lutheran chapel, shipyards, warehouses, barracks, a clubhouse for the officers, a sawmill, a foundry where brass, copper and iron castings of moderate size were made, beside numerous dwellings. All the buildings were log structures, their outer walls washed with yellow ochre, the roofs chiefly of metal painted red. High above the rest, on an elevated rock, rose a large building, in which the governor of the Russian colonies had his residence. This, known to visitors as the 'castle,' was built of squared logs, with two stories and a cupola, and was defended by a battery. The warm colors of the buildings, above which rose the pale green spire and bulbous domes of the Greek church, seen against steep, snow-tipped mountains densely clothed with sombre forests of spruce, produced a picturesque effect unique among American settlements.

Outside the walls, along the beach, was a long row of large Indian houses, low and wide, without windows, built of immense planks painfully hewn out of single logs with stone adzes, whose marks could still be distinctly seen. They were entered by small, low doors, rounded above, so that he who came in must bend to an attitude ill suited to defense. The front of each house was painted with totemic emblems in red ochre. Their dimensions were sometimes as much as 40 by 60 feet, and the area within formed one large room, with the rafters visible overhead, the middle portion floored only with bare earth, on which the fire was built, the smoke escaping through a large square hole in the roof. On either side were raised platforms with small partitioned retreats like state rooms, each sheltering a single family. As many as one hundred people sometimes dwelt in one of these houses. The only ornaments were totemic carvings, generally against the wall opposite the entrance; overhead hung nets, lines and other personal property, drying in the smoke, along with strips of meat or fish and fir branches covered with the spawn of herring.

On the bank, which rose behind the houses, densly covered with herbage of a vivid green, were seen curious box-like tombs, often painted in gay colors or ornamented with totemic carvings or wooden effigies. These tombs sheltered the ashes of their cremated dead. On the beach in front of the houses lay numerous canoes whose graceful shape and admirable workmanship extorted praises from the earliest as well as the later explorers of the coast. When not in use these were always sheltered from the sun by branches of spruce and hemlock or tarpaulins of refuse skins. Among the canoes innumerable wolfish dogs snarled, fought, or played the scavenger.

The natives still retained to some extent their original style of dress, modified now and then by a Russian kerchief or a woolen shirt. As a rule they were barefooted, stolid, sturdy, uncompromising savages, who looked upon the white man with a defiance but slightly tempered with fear and a desire to trade. The mission church of that day was built into the stockade, with doors entering it both from the Indian and Russian town. When services were held, the outer door was opened, the town door closed and stoutly barred. Once these fierce clansmen had endeavored to rush into and take the settlement when the door leading inward had been left unfastened. From the time when the first white men to touch these shores, Chirikoff's boat's crew in 1741, were without provocation massacred, these natives had not failed to maintain their reputation for courage, greed, treachery and intelligence.

These conditions outside the settlement necessitated a military discipline within it.

Sentries regularly paced the walks by day and night, the sullen Indians were systematically watched, and the little batteries kept in readiness for use.

The needs of the business of the company made Sitka a lively manufacturing town, in spite of the multitudinous Russian holidays. Society there was like a bit of old Russia, with the manners, vices and sturdy qualities of sailor, peasant and courtier fully exemplified within its narrow limits. A fishery at Deep Lake, a few miles away, furnished fresh salmon in abundance, which was freely distributed to all comers, twice or thrice a week during the season. The company furnished each employee with certain stated rations of flour, sugar, tea, etc., at fixed prices; the harbor, within a few yards of the stockade, contained abundance of seafish, and the Indians' price for a deer, skinned and dressed, was a silver dollar or a glass of vodka. The primeval forest came close to the town; the demand for firewood and timber had made little impression upon it. White settlements in the Alexander archipelago were confined to a few small fortified trading posts. Fort Wrangell and Fort Tongass alone could be regarded as approximately permanent. The parties sent out to trade or hunt worked from a temporary camp or an armed vessel as a base, and, owing to the ill feeling which existed between the natives and Russians, smuggling and illicit trading were rife. Missionary effort did not exist outside of Sitka, and even there amounted to little more than the bribery of some greedy savage, to perform for a consideration some rites which he did not understand.

The law of Russia which prevented a permanent severance of a subject from his native soil (except for crime) operated to encourage temporary unions of the company's servants with native women. Marriages were not allowed between full-blooded Russians and natives, as, at the expiration of his term of service, the Russian must return to his own parish in Russia, and the native could not be carried away from the place of her nativity. After the transfer of Alaska to the United States many of these Russians elected to remain in the country and were married to the mothers of their children; but at the time of our first visit, the most surprising social fact to us was the perfect equality which appeared to subsist between these irregular partners and the married women who had come from Russia. So far as we could perceive, both classes behaved with equal propriety and were treated with equal respect by the community, and the only restriction which the authorities insisted upon was that no Russian should take to himself a partner who had not been duly baptized. The issue of these unions, being of Alaskan birth, were free to marry in the country, and with their descendants constituted the class to which the Russians gave the name of 'Creoles.' Some of them rose to eminence in the service, and one at least became governor of the colonies.

At the time of our visit the business of the colony was exclusively the development of the fur trade. Agriculture was confined to a trifling amount of gardening very imperfectly performed. The fisheries were utilized only to supply food for the people in the company's employ, or to insure subsistence for the natives whose time was devoted to hunting the sea otter or preparing skins for the authorities. The fur trade of southeastern Alaska was not very productive. The natives were disposed to trade with the Hudson Bay Company or illicit traders rather than with the Russians, partly because they obtained better prices for their skins and partly because the Russians refused to trade intoxicating liquors, while the outsiders were not troubled with any scruples in such matters. The furs were divided by the Russians into two

classes—the precious furs, such as the fox, sea otter and sable, which were strictly reserved for the company, a certain proportion being imperial perquisites of the Russian court, and the cheaper sorts, which might be used by the company's employees for winter clothing, and were sold at a fixed price to them for this purpose. This included the muskrat, mink, Parry's marmot or ivrashka, the fur seal and some others. Dry skins of the fur seal were sold at the company's warehouse for 12½ cents apiece, the modern plucking and dyeing of the fur, invented by an American, Raymond, of Albany, not having reached a perfection sufficient to attract the fashionable world.

The European trading goods and supplies were mainly brought by ship from Hamburg, the same vessel taking the annual load of skins to China, where an exchange was made for tea and silk, which were carried back to Europe. Flour was imported latterly from California and some goods were brought from Aian and other ports on the Okhotsk sea in the earlier days of the business, but in 1865 this trade had come to a standstill or nearly so. In mineral resources almost nothing was done; a little coal was taken out at Cook's inlet for local uses, and the exportation of ice from Kadiak to California was carried on under a lease by an American company. The presence of gold, iron and graphite was known to the authorities, but prospecting was not encouraged, as it was supposed the development of mineral resources might react unfavorably on the fur trade.

The first codfisherman visited the Shumagin Islands in 1865. The whale fishery was wholly in the hands of Americans and other foreigners, uncontrolled by the Russians, and the timber was used only for local purposes.

The main business of the company was done at its continental trading posts in the northern part of the territory and in the Aleutian chain; its authority in the territory was as absolute as the presence of the uncivilized tribes would admit. Under the guns of the trading posts the company was master; out of their range every man was a law unto himself.

After transacting its business at Sitka, the expedition touched at the island of Unga to examine a coal mine, at Unalashka, the Pribiloff Islands, and at Saint Michael's, Norton Sound, where Kennicott and the explorers for the Yukon were landed. The speaker was put in charge of the scientific work of the expedition and remained with the fleet, visiting Bering Strait, where landing places for the cable were searched for; and Petropavlovsk, the capital of Kamchatka, where the Siberian parties were provided for; and then the vessels returned to San Francisco.

The following year, on returning to Saint Michael's, we were met by the news of Kennicott's death from heart disease, brought on by over-exertion and anxiety. The Yukon exploration was still incomplete, though information received made it certain that the Kwikhpak of the Russians and the Yukon and Pelly of the English were one and the same river. It remained to emphasize this information by a continuous exploration which should cover the unmapped portion of this mighty stream. The scientific work in zoölogy projected by Kennicott had been left by his premature death unrealized. The speaker determined to carry out these plans and was authorized to remain in the country for that purpose.

As soon as sufficient snow had fallen to render sledging practicable a portage from Norton sound to the Yukon river was traversed, a small boat transported on a sledge for use during the following summer, and the Yukon ascended on the ice to the trading post at Nulato, a distance of some three hundred miles. Here the party of five wintered and in March divided into two

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parts—one, under Frank Ketchum, taking sledges with the intention of traversing the unknown region on the ice and after reaching Fort Yukon to ascend further in canoes; the other to await the break-up of the ice in May and follow in the skin canoe, so as to rescue the first party should they have failed to carry out their plans. Both projects were successfully carried out and the two parties reunited at Fort Yukon on the 29th of June, 1867. They returned by the whole length of the river and reached Saint Michael's on the 25th of July. Here astonishing news awaited us: The Atlantic cable was a triumphant success, the United States were in negotiation for the purchase of Russian America, our costly enterprise was abandoned, and all hands were to take ship for California.

The collections and observations had been but half completed. The natural history of the Upper Yukon and the borders of Norton sound had been pretty well examined, but the vast delta of the Yukon, with its wonderful fauna of fishes and water birds, its almost unknown native tribes and geographic features, remained practically untouched. I immediately determined to remain and devote the following year to the unfinished work. An arrangement with the Russians was made and this plan carried out. In the autumn of 1868 I left Norton sound for California on a trading vessel and returned to civilization.

At the time our explorations of the Yukon began this immense region was occupied by two or three thousand Indians, many of whom had never seen a white man. The Russian establishments on the Yukon were only three in number, hundreds of miles apart, and chiefly manned by Creole servants of the company, not over a dozen at each post. An inefficient priest, with a few alleged converts, conducted as a mission of the Greek Church the only religious establishment in the whole Yukon valley. The industries of the region comprised trapping, hunting and fishing; the first for revenue, the others for subsistence. The means of navigation were birch-bark canoes and small skin-boats. Once a year the clumsy barkass of the Russians, loaded with tea, flour and trading goods, was laboriously forced upstream to the Nulato post, returning with a load of furs. The tribes of Eskimo extraction occupied the lower river banks from the sea to the Shageluk slough, above which they were replaced by Indians of the Tinneh stock. These were to be found in scattered villages at various points on the river or its tributaries, where the abundance of fish offered means of subsistence. The extreme limit of population was to be found at the junction with the Yukon of the large river Tananá, where the island of Nūklūkayét was recognized as neutral ground, where delegations from all the tribes met in the spring for their annual market of furs. Here our party had the interesting experience of meeting the delegation of Tananá Indians in full native costume of pointed shirts and trousers of dressed deer skin adorned with black and white beads, the nasal septum pierced to carry an ornament of dentalium shell, their long hair formed into a bundle of locks, stiff with tallow, wound with beads, dusted with powdered hematite and the chopped down of swans. The ranks of frail birch canoes were accurately aligned, and their paddles rose and fell with military precision. When they rounded the point of the island and approached the beach, where stood the first white men they had ever seen, they were met by a complimentary salvo from the guns of the Indians already on shore, and responded by wild yells and graceful waving of their paddles.

The waters of the Tananá had never known an explorer and its geography was wholly unknown. Never again will it be possible for an ethnologist to see upon the

Yukon such a body of absolutely primitive Indians untarnished by the least breath of civilization.

Above Nūklūkayet the Yukon enters a cañon, known as the Lower Ramparts, above which the depopulated area already alluded to extends to the site of Fort Yukon, near the British boundary on the Arctic circle.

The noble stream I have described extends, including windings, about 1,600 miles from Fort Yukon to the sea. The valley is sometimes wide and low, sometimes narrow, and contracted by low, wooded mountains. Everywhere until the delta is approached the banks are wooded. There are many tributaries, none of which were then explored, and on either side of the main artery the land stretched unexplored for hundreds of miles. Not another person speaking any European tongue, except the Russian, was resident in all this territory during the second year of my sojourn. Outside of the three trading posts, not a native had ever bought a pound of flour or an ounce of tea. The use of woolen clothing had hardly begun, and soap was a rare and costly luxury. I made the first candles ever molded on the Yukon, and but for the lack of hardwood ashes to furnish alkali would have tried my hand at soap. People lived on game and fish. The caribou was plentiful in the absence of rifles; the moose was not yet exterminated; the warm days of spring brought incalculable multitudes of ducks and geese, to say nothing of other water fowl; the Arctic rabbit and the ptarmigan were a constant resource, and the rivers and lakes in many places teemed with fish. Clothing was made of deerskin and sewed with sinew; the ornaments were fringes from the gray wolf or wolverine. Undergarments were occasionally made of cotton bought from the traders, but more usually from the skins of fawns. At one village during the season for taking them I saw 4,300 fawn skins hanging up to dry. Such reckless destruction has since borne its natural fruit. It was only at certain localities even then that deer were plentiful. The main staple of subsistence was fish. During the summer the river was studded with traps for salmon; in winter the traps were set in the ice, and under favorable conditions furnished a steady supply of white-fish, burbot, pike, grayling and the great red sucker. The salmon were cleaned, split into three parts connected at the tail, and dried in the open air by millions; they furnished food for man and dog, and when well cured were not unpalatable. Vegetable food was almost unknown, except in the form of berries. The green flower stalks of *Rumex* and *Archangelica* were occasionally eaten, and the dwellers by the sea sometimes gathered dulse, but for practical purposes the diet was meat and fish.

It was known that gold existed in the sands of the river, but the inexperienced fur traders looked for it in the bars of the main river and not in the side cañons of small streams, where it has since been found in such abundance. The real riches of the Yukon valley then lay in its furs. In a garret at Fort Yukon the post trader showed me with pardonable pride 300 silver fox skins of the first quality. Beautiful in themselves and for what they represented —gold, praises, and promotion in the service—one might almost forget that some of the company's servants at this post had not tasted bread or butter, sugar or tea for seven long years.

The region of the delta was, and is still, remarkable as being the breeding place of myriads of water fowl, some of which are peculiar to the Alaskan region. Nearly one hundred species gather there, and one of them comes all the way from North Australia, by the coasts of China and Japan, to lay its eggs and rear its young in the Yukon delta. It is also remarkable for the abun-

dance of the great king salmon, sometimes reaching a weight of 130 pounds, a fish less plentiful further up and which does not ascend to the headwaters of the river.

All this immense Territory has since been penetrated by traders and prospectors. Stern-wheel steamers have defied the current, and ply regularly on the river during the season of open water. Mission schools are numerous and reindeer scarce. The fur trade wanes, while many thousands of dollars in gold dust have been laboriously extracted from the gravels. The natives buy tea and flour and dress in woolen clothing. With the miners whisky has reached the wilderness, and the sound of the American language is heard in the land. Tame reindeer have been imported from Siberia with a view to their domestication by the Eskimo of the Arctic coast, who are on the verge of starvation at frequent intervals, owing to the destruction of their food supply by the whalers and walrus hunters and the introduction of Winchester rifles for killing the wild deer. With the alternative of starvation as a stimulus, the chances of success ought to be good.

In carrying out the plans which Kennicott had meditated, but which death had stayed, I had succeeded in gathering rather abundant material for my friends, the ornithologists, botanists, ethnologists, and so on, but to do it I had to put aside the work in the department in which I personally was most interested. The shores of Norton sound and the tundra of the Yukon valley offered little in the way of mollusks or other invertebrates. The desire to extend our knowledge of the geographical distribution of the sea fauna led me to propose a further exploration of the coasts of the Territory, especially of the Aleutian chain, under the auspices of the United States Coast Survey. A geographical reconnaissance was undertaken and carried on during five years, investigating magnetism and hydrology, making charts, tidal observations, meteorological and hypsometric notes. In all this I was ably seconded by my companions, Mark W. Harrington and Marcus Baker, who need no introduction to this audience. At the same time, and without interfering with the regular work, the dredge was kept constantly busy, and on my return from field work the material for the studies I had so long looked forward to was actually gathered.

The region which includes the Aleutian chain and other islands west of Kadiak presents a striking contrast to the densely wooded mountains and shining glaciers of the Sitkan region to the east and the rolling tundra cut by myriad rivers in the North. Approached by sea, the Aleutian islands seem gloomy and inhospitable. Omnipresent fog wreaths hang about steep cliffs of dark volcanic rock. An angry surf vibrates to and fro amid outstanding pinnacles, where innumerable sea birds wheel and cry. The angular hills and long slopes of talus are not softened by any arborescent veil. The infrequent villages nestle behind sheltering bluffs, and are rarely visible from without the harbors. In winter all the heights are wrapped in snow, and storms of terrific violence drive commerce from the sea about them.

Once pass within the harbors during summer and the repellent features of the landscape seem to vanish. The mountain sides are clothed with soft yet vivid green and brilliant with many flowers. The perfume of the spring blossoms is often heavy on the air. The lowlands are shoulder high with herbage, and the total absence of trees gives to the landscape an individuality all its own. No more fascinating prospect do I know than a view of the harbor of Unalashka from a hilltop on a sunny day, with the curiously irregular, verdant islands set in a sea of celestial blue, the shorelines marked by creamy surf, the ravines by

brooks and waterfalls, the occasional depressions by small lakes shining in the sun.

The sea abounds with fish; the offshore rocks are the resort of sea lions and formerly of sea otters; the streams afford the trout fisher abundant sport, and about their mouths the red salmon leap and play. In October the hillsides offer store of berries, and in all this land there is not a poisonous reptile or dangerous wild animal of any sort.

The inhabitants of these islands are an interesting and peculiar race. Their characteristics have been well described by Veniaminoff, who knew and loved them. By the testimony of their language, physique and culture they are shown to be a branch of the Eskimo stock, driven from the continent, as the shell heaps reveal, at a very ancient date and isolated since from contact with any other native race, specialized and developed by their peculiar environment to a remarkable degree. Conquered by the Russian hunters of the eighteenth century, practically enslaved for a century, their ancient religion frankly abandoned for the rites of the Greek Church, an apathetic reticence replaced the rollicking good nature characteristic of the Eskimo people. In 1865 they were supported by the company; the men shipped off in hunting parties in search of the sea otter were separated from their families sometimes for many months and rewarded according to their success; but, while the company provided food for all who needed it, the time of the Aleut was not his own. I have already mentioned that the fur seal at that time had very little commercial value. The fishery on the Pribiloff Islands was conducted by Aleuts under supervision, and the skins were mostly shipped to China or Europe. It has been noted as surprising that the value of the fur-seal fishery is so little referred to in the arguments urging the acquisition of the Territory in 1867. This was not an oversight; the seal fisheries at that time were not especially lucrative, and the millions which the industry has since produced could not have been predicted in 1867.

(*To be continued.*)

*A SIMPLEX SPECTROSCOPE.**

FOR the purpose of explaining the construction and operation of the spectroscope to beginners, the simplest form was desired and after various modifications of the usual form had been constructed, the following arrangement was devised and has proved eminently satisfactory, No lenses are required and only a small prism of fair quality.

The apparatus is shown in perspective in Fig. 1†. P is the small prism, about 1.5 cm. on a side and 60° refracting angle. B is an ordinary Bunsen burner with chimney. AC is a metal screen, supported upon a stand, and having a rectangular opening in its center covered by a scale in millimeters upon translucent paper or celluloid, covered upon the back with mica to protect it from the burner. Under the center of the scale is a triangular opening about 8 mm. high and 5 mm. wide at its base. The plan of the location of the parts is shown in Fig 2. The scale AC is about 50 cm. from the prism.

The operation of the spectroscope is as follows: The light from the burner B, passing through the opening D, falls upon the prism P and is refracted into the eye placed somewhere at E, and the light appears to come from a direction similar to D′ E. The scale is illuminated with a strong sodium light, obtained either by placing a 'sodium chimney' on the burner B, or by putting a sodium bead in the top of the flame. The scale being seen only by sodium light appears clear and distinct in

* Unpublished paper by Holbrook Cushman; edited by W. Hallock. See SCIENCE, December 6, 1895, p. 757.

† See SCIENCE, December 6, 1895, note on p. 761.

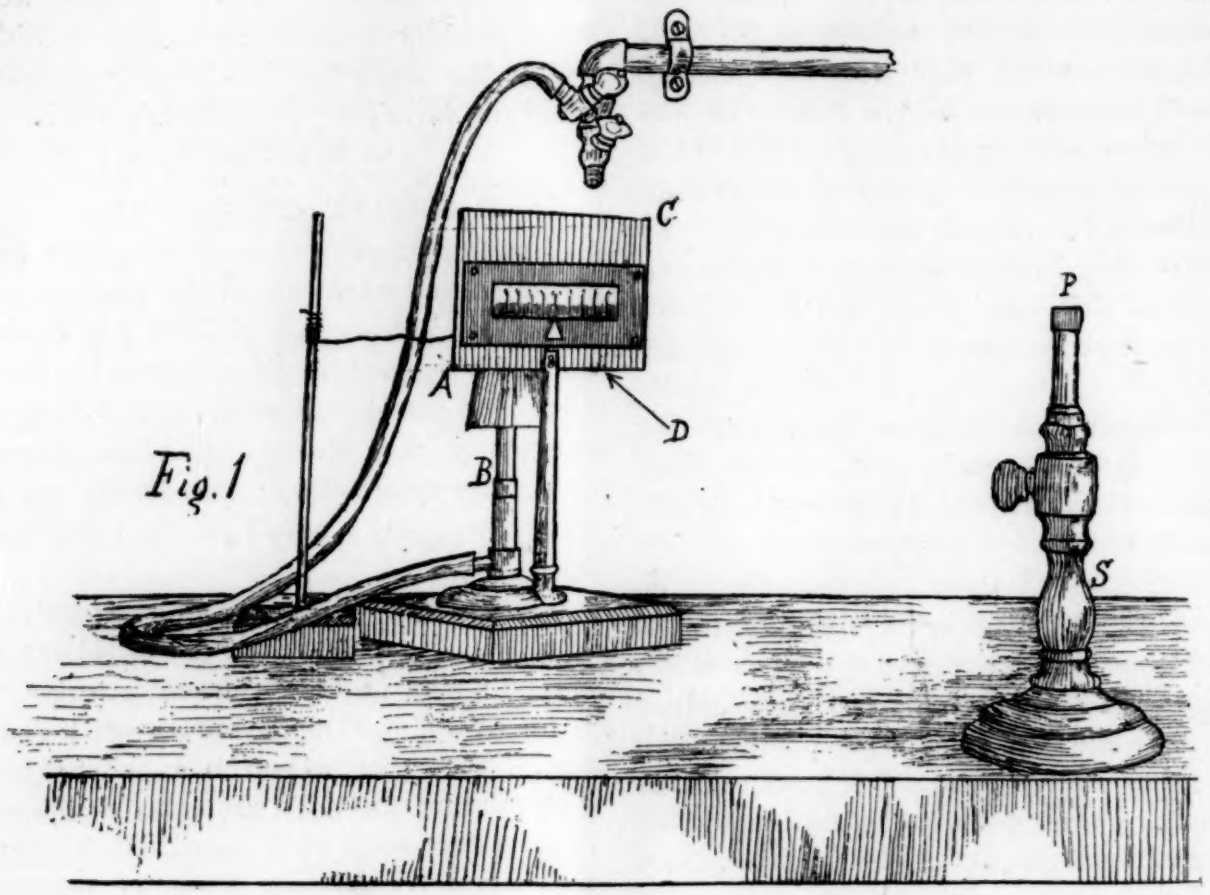

Fig. 1

some position as at A′ C′. If, for example, strontium is introduced into the flame the observer will see a red triangle appear under the scale A′ C′ at some such place as D″, Figs. 2 and 3. If thallium is used a green triangle will appear as at D‴. In other words one can read the positions of the points of the colored triangles at the bottom of the scale, just as the positions of the colored lines are read on the scale in an ordinary spectroscope. A little practice and care will enable one to read the positions of the triangles to 0.1 mm, and thus to obtain about as good results as with the customary more elaborate and more expensive form. This little piece of apparatus has proved a great help in making the principles of the spectroscope thoroughly clear to students doing laboratory work. Of course it is desirable to have a black screen to prevent light from entering the eye from the direction of A′ C′. In fact it is very convenient to blacken the wall for a considerable space behind this apparatus.

COLUMBIA COLLEGE, December 10, 1895.

THE GEOLOGICAL SOCIETY OF AMERICA.

THE Geological Society of America held its eighth annual meeting in the main building of the University of Pennsylvania, at Philadelphia, December 26, 27 and 28. The first session of the Council took place at the Hotel Lafayette at eleven o'clock on the 26th. The ballot for officers was canvassed with the following result:

President, Joseph Le Conte, Berkeley, Cal.; First Vice-President, Charles H. Hitchcock, Hanover, N. H.; Second Vice-President, Edward Orton, Columbus, O.; Secretary, H. L. Fairchild, Rochester, N. Y.; Treasurer, I. C. White, Morgantown, W. Va.; Editor, J. Stanley-Brown, Wash-

Fig. 3.

Fig. 2.

ington, D. C.; Councillors, B. K. Emerson, Amherst, Mass., and J. M. Safford, Nashville, Tenn.

The newly elected Councillors replace E. A. Smith and C. D. Walcott who retire under the rules. The other members are F. D. Adams, I. C. Russell, R. W. Ells and C. R. Van Hise. The following fellows were also announced as elected:

Harry Foster Bain, B. S., M. S., Des Moines, Iowa, assistant geologist, Iowa Geological Survey.

William Keith Brooks, Ph. D., Baltimore, Md., professor of zoölogy in Johns Hopkins University.

Charles Rochester Eastman, A. B., A. M., Ph. D., Cambridge, Mass., assistant in paleontology in Museum of Comparative Zoölogy and in Harvard University.

Henry Barnard Kümmel, A. B., A. M., Ph. D., Trenton, N. J., assistant on the State Geological Survey of New Jersey.

William Harmon Norton, M. A., Mt. Vernon, Iowa, professor of geology in Cornell College, special assistant on the Geological Survey of Iowa.

Frank Bursey Taylor, Fort Wayne, Ind. Accountant, engaged in pleistocene geology.

Jay Backus Woodworth, B. S. Cambridge, Mass., instructor in Harvard University

and assistant geologist on U. S. Geological Survey, engaged in general and glacial geology.

The Council also distributed a printed report containing the resumé of the year. The last printed roll contains the names of 223 living and 13 deceased fellows of the Society. Four have died during the year. The financial affairs of the Society are in good condition. After a few announcements, memorials of deceased members were presented as follows: of James D. Dana, written by Joseph Le Conte and read by H. S. Williams; of Henry B. Nason, written by T. C. Chamberlin and read by Bailey Willis; of Albert E. Foote, written by G. F. Kunz and read by J. F. Kemp; of Antonio del Castillo, written by Ezequiel Ordonez and read by the Secretary.

The reading of scientific papers was then taken up with the usual rule that papers whose authors were not present in person were passed and transferred to the end. The papers actually read came in the following order.

Illustrations of the Dynamic Metamorphism of Anorthosites and related Rocks in the Adirondacks. J. F. Kemp, New York, N. Y.

The high, central peaks of the Adirondacks and the larger outlying ridges consist of anorthosite, a coarsely crystalline rock that is nearly pure labradorite. Though described as norite in earlier reports, it is noticeably poor or entirely lacking in ferro-magnesian silicates. In the course of a fairly extensive reconnoissance of the principle portion of the mountains, the writer has met but limited exposures of the anorthosites in an uncrushed condition. Specimens of such were shown, and beginning with these as a starting point the gradual development of crushed rims was shown, which at first barely discernible, increased until the original crystals of labradorite were but small nuclei. The extreme is a 'pulp-anorthosite' with no nuclei. The passage into gneissoid forms, through augen-gneisses, and with a rich development of garnets, was also illustrated. The final result is a thinly laminated gneiss. Comments on the areal distribution of these types were added. The speaker then took up a series of basic gabbros and illustrated, by specimens, their passage into gneissoid types in the same exposure. Acknowledgments are to be made to Prof. James Hall, State Geologist of New York, under whose direction a part of the material used for illustration was gathered. The paper was discussed by A. C. Lane and C. H. Hitchcock, bringing out the facts that in the gabbros the change to gneiss was generally marked by a passage of pyroxene to hornblende, and that the igneous series, though called Upper Laurentian by the speaker in following the Canadian usage, was doubtless later than the crystalline limestones of the region, that would be called Algonkian by many American geologists.

The Importance of Volcanic Dust and Pumice in Marine Deposits. N. S. Shaler, Cambridge, Mass.

Considerations based on volcanic action in the Java district make it probable that the extrusions of rock matter in the form of dust and pumice may exceed that which is carried to the sea by the rivers and possibly equals that which is conveyed to the ocean by all other actions. Observations on the shores of the United States afford evidence that there is a noticeable contribution of pumice to the deposits forming along that coast line. The facts warrant the supposition that the value of these volcanic contributions to sedimentation has not been properly appreciated.

The paper elicited an extended and interesting discussion. C. H. Hitchcock, apropos of the recorded discoveries of pumice along the southern coast line of the United

States, stated that in his travels in the West Indies he had found no pumiceous rocks among the volcanoes, and suggested the possibility of remoter sources. C. W. Hayes remarked upon a vast formation of volcanic tuffs met by him in eastern Alaska, extending over many hundreds of square miles and up to 75 feet thick. Its bulk he estimated at over 100 cubic miles. He also referred to the top layer of the Devonian rocks of the southern Appalachians, which 8 inches to 18 inches thick, extends from eastern Tennessee and Georgia to Arkansas and Missouri, and which is regarded as a volcanic tuff. L. V. Pirsson mentioned the wide area over which the fine ejectments of Krakatoa had spread and gave a brief sketch of Bäckstrom's observations on the presence of volcanic dust in the sea beaches of Norway. Much of this is demonstrably from Iceland, but other samples agree with the products of no volcano in the Atlantic basin. Caution is needed not to be misled by artificial slags and cinders. M. E. Wadsworth cited the tuffs collected by S. Garman, G. P. Merrill and J. S. Diller in Nebraska, and by Diller in Massachusetts. Persifor Fraser called to mind the dust that was gathered by Joseph Wharton in Philadelphia on the first snowfall, December, 1883, Krakatoa having been active in August of the same year. Its microscopic characters agreed entirely with samples from Krakatoa.

The discussion then took up the length of time, during which such dust might remain suspended in the atmosphere. W. M. Davis stated that the peculiar red sunsets following the Krakatoa outbreak lasted through 1884, and that the so-called Bishop's ring was visible around the sun for fully two years. N. S. Shaler mentioned the observations of the Germans on shining clouds that were at first 80 miles in the air and that were later noted at 140 miles before they disappeared. He also reminded the Society that the same red sunsets followed the great eruption of Skaptar Jokul in 1783. C. H. Hitchcock raised the point that red glows from aqueous vapor should not be confused with colors from volcanic dust, as the latter are chiefly greenish, but in reply it was brought out that the colors were due to diffraction and that the reds might also be caused by fine particles of mineral matter.

A needed term in Petrography. L. V. PIRSSON, New Haven, Conn.

The speaker adopted the definition of a crystal that is based upon its outer plane faces, rejecting thus the tendency of some authors to make it dependent on internal, physical and optical properties. He then spoke of the inaccuracy of using the word crystal for the mineral components of a rock, which, in most cases, have no plane faces, illustrating his point by the augites of augitic rocks. For such the terms crystal fragment and crystalloid had been used, but were both objectionable. Therefore, after consultation with E. S. Dana, he proposed the name anhedrine for them, the word meaning without planes. In a brief discussion that followed, the term was on the whole well received, although the general feeling was strong against the introduction of further new terms into the over-burdened nomenclature of petrography and other branches.

Note on the Outline of Cape Cod. W. M. DAVIS, Cambridge, Mass.

The speaker described the topography of the Cape from a point some distance south of Highland Lighthouse, to the north, and made a distinction between the 'mainland outline' or the original glacial drift hills of the highlands, and the 'constructional outline' by which was meant the later added sandspit to the north. The argument was then made that the 'mainland' had once extended some miles to the southeast, that it had been worn away at first to a some-

what northwesterly coast line, now indicated by an inshore sandspit, in the constructional area, and later to a more northerly line as shown by the building of the present spit from the 'point of attachment' in sympathetic conformity to the cliff line on the south. The migration of the sediment worn from the cliff around the end of the point, the features of Race Point and Long Point and the crescentic scouring of the inner side of the cape, were all commented on. G. K. Gilbert asked if there is any evidence of the elevation or depression of the cape area *en bloc*, to which the speaker replied that there is none. C. H. Hitchcock recalled the idea of Louis Agassiz that there had once been a continuous line of drift from Cape Ann to the 'mainland' of Cape Cod, but the speaker said it had been long disproved, and referred also to historic records of islands off to the southeast of Highland Lighthouse. In closing the discussion President Shaler stated that the 'mainland' of the cape was formed by a deposit of drift on an old preglacial divide of Tertiary and Cretaceous strata, and that the former river systems could be traced with entire accuracy southward through Vineyard sound. He dwelt also on the fear of the Provincetown people lest the cape to the east of them should be breached and their harbor be filled with sand. The value of jetties north of the 'point of attachment' referred to above was emphasized.

The Society then adjourned until the following day at 10 A. M. Thursday evening many of the Fellows attended the interesting lecture of Prof. Wm. B. Scott on the Tertiary Lake Basins of the West, at the Philadelphia Academy of Sciences, and all who are accustomed to arc-light stereopticons were strengthened in their faith in them, as the lime light provided did not do Prof. Scott's slides justice. Nearly all the Fellows also attended and enjoyed the reception which was most hospitably extended to the visiting societies by Dr. Horace Jayne, to whom an expression of thanks is due.

The Council of the Society met at 9 A. M. Friday and transacted routine business. At 10 the Society assembled and devoted a few minutes to executive business. The auditing committee and the committee on photographs reported. The latter placed on exhibition the collection which now amounts to 1283 pictures, many of which are of more than ordinary interest. 205 new ones were added during the year. Great credit is due the efficient chairman of the committee, Dr. Geo. P. Merrill, of the United States National Museum, for his efforts in its behalf. The committee solicits donations which may be sent to Dr. Merrill and which will be duly acknowledged in the publications of the Society. The Society also voted not to have a session separate from Section E of the American Association at the summer meeting, but only one for executive business and for the reading of papers by title. Attention will also be given to arranging excursions as heretofore. Fellows of the Society are urged to read their papers in Section E, while publishing as before in the *Bulletin*. It was announced that a group photograph would be taken at the noon recess. This was afterward done, with a quite successful result, by Herbert Hoffman, of 914 Arch street, Philadelphia. The business finished, the Society listened to the annual presidential address. It was delivered by retiring President Shaler, and will appear in full in an early number of Science. The subject was 'The Relations of Geologic Science to Education,' and it was followed by some discussion by Messrs. Gilbert, H. S. Williams and Wadsworth. The regular papers were then taken up as follows:

Plains of Marine and Subaerial Denudation.
W. M. Davis, Cambridge, Mass.

Ramsey's explanation of plains of abrasion as the product of marine denudation

(1847) found general acceptance, and in England to this day hardly any serious consideration is given to any other explanation. The production of plains of abrasion at the completion of a cycle of subaërial denudation, advocated by Powell in connection with the idea of the baselevel of erosion (1875), has found wide acceptance in this country, but it is less approved abroad. The paper considered the criteria by which plains of abrasion of one origin or the other may be distinguished. When such plains are uplifted and maturely dissected in a second cycle of denudation the difficulty of determining their origin increases. It is suggested that plains of subaërial denudation may be recognized, even when uplifted and dissected, by the degree of adjustment of their streams to their structures; thorough adjustment requires a longer time of stream action than has passed since uplift; much of the adjustment must be referred to a previous cycle of denudation, which is thus shown to have been a subaërial cycle.

Considerable discussion followed by Messrs. Willis, Reid, Hayes, Van Hise and Gilbert, the speakers giving instances from different parts of the continent, which illustrated one or the other interpretation cited, or which emphasized the large part played by the character of the rocks concerned or by isostatic adjustments.

Cuspate Fore-lands. F. P. GULLIVER, Cambridge, Mass.

1. Action of waves, tides and currents. Waves attack the whole coast, but erode more rapidly on headlands than at bay heads. Tides are less effective agents of transportation along shore on exposed coasts than currents, but they are the important agents in sounds, channels and inlets.

2. Current cusps. Type, Cape Hatteras. The cusp is formed in the dead water between two eddy currents.

3. Tidal cusps. Type, West Point, Puget Sound, Washington. The cusp is formed between eddies of in- and out-flowing tides.

4. Delta cusps. Type, Tiber delta, Italy. The mouth of the river forms the point of the cusp, on either side of which the along shore currents arrange the detritus.

The paper was illustrated by pilot charts, which somewhat unfortunately were not all used, as space for display was limited. Bailey Willis remarked on the applications of the views advanced to localities in the Puget sound region.

Drainage Modifications and their Interpretation. M. R. CAMPBELL, Washington, D. C.

This paper opened with a discussion of the subject of stream modification under the influence of slow elevation or depression of the earth's surface. From this was derived the Law of the Migration of Divides which control, to a greater or less extent, the alignment of all drainage systems. The Law of the Migration of Divides is in brief that divides migrate toward a region of uplift and away from a region of depression. The relations of divides may therefore be significant indicators of the lines of upheaval or depression even when these are comparatively slight. Criteria were given by which these modifications may be recognized and the character of the crustal movement determined.

A brief description followed of some of the drainage systems of the Appalachian province, south of the glaciated region, to show that similar modifications of the drainage are of common occurrence, not only in the regions of horizontal rocks, but also occur in the highly complicated geologic structure of the Appalachian valley. It was shown that some of these changes are of recent occurrence, whereas some probably date back to the time of the Jura-Trias depression.

The principal object of this paper was to show that the drainage of the Appalachians constitutes a record of Mesozoic history, and that this record is to the physiographer of equal importance with that contained in the forms sculptured from the surface of the land.

In the discussion President Shaler took up the relations of the drainage systems of Kentucky and emphasized the value of the paper in helping to clear away points that were previously obscure. Remarks by Messrs. Davis and Gilbert followed, and the latter in reply to a question alluded to the part played by the rotation of the ear th in determining lines of drainage. He described it as slight, if at all present, and as requiring almost unattainable delicacy of tests for its detection.

Some Fine Examples of Stream Robbing in the Catskill Mountains. N. H. Darton, Washington, D. C.

By means of a large topographical chart the speaker showed how the Kaaterskill and Plaaterskill Creeks flowing eastward into the Hudson, had pushed their divides backward until they had robbed the headwaters of Schoharie creek. Other smal[1] ones along Esopus creek were also cited.

Movement of Rocks Under Deformation. C R. Van Hise, Madison, Wis.

The paper was a general discussion of the behavior of rock when subjected to deforming stresses, and is preliminary to the discussions which the author gave last summer on the analysis of folds and upon the relations of primary and secondary structures in rocks.

Three zones in the earth's crust were cited: 1, an outer one of fracture during rock movement; 2, an inner one of mixed fracture and flowage; 3, an inmost one of flowage. In elaborating these, the effects of pressure on rocks were analyzed. It was shown that a quick application of pressure might fracture where a slow one would cause flowage, and that the possible depth at which cavities might exist was greater than had been assumed by Heim (5000 m.). Mathematical deductions by Prof. Hoskins, of Stanford University, made for this paper, have shown that where the walls of a cavity are subjected to three equal stresses at right angles with one another, the cavity will be closed up in case the stresses equal two-thirds the ultimate strength of the rock. With a single stress the full crushing pressure is needed. Assuming the strongest rock for these conditions in order to get a certain maximum depth below which cavities would be an impossibility, and taking the specific gravity of the crust at 2.7, from which in the calculation we must subtract 1, for the water that penetrates all fissures, we obtain for the first relation of forces 6670 metres and for the second 10,000 metres as this depth. Under these conditions the water is understood to be free to escape. Instances of quartz pebbles were cited, one being rolled out without fracture in the Marquette region. The effects upon heterogeneous rocks were discussed and their relations to folding. The zone of mixed crushing and folding was next taken up, after which the paper concluded. In the discussion A. C. Lane spoke of the bearing of the paper on the conceptions advanced by him at a previous meeting regarding the escape of the earth's internal gases. J. F. Kemp referred to its important bearing on the origin and possible depth of formation of mineral veins. B. K. Emerson cited the case of the Cambrian gneisses of Massachusetts, in which quartz crystals are rolled out as thin as paper, but with their optical properties unimpaired, and emphasized the possibility of chemical recrystallization. J. P. Iddings brought up the interesting experiments of O. Mügge on ice crystals as recently set forth in the Neues Jahrbuch, showing that ice sheared

in small blocks along gliding planes across the optic axis without altering its direction. Prof. Van Hise in closing admitted the possibility of chemical recrystallization, citing in illustration some marbles which exhibited it, but mentioned others that are full of strained and crushed crystals. The paper was one of the most important of the meetings and is indispensable to all students of metamorphic districts.

Proofs of the Rising of the Land around Hudson Bay. ROBERT BELL, Ottawa, Canada.

The speaker cited well preserved sea margins and grand terraces, especially on the eastern coast; lines of driftwood above highest tides; debris along old shore lines in the woods on the west side at a distance from the highest tides; islands near shore becoming peninsulas within the human period; drying of salt water marshes; the character of the lower parts of streams showing recession of the sea; shoaling of mouths of rivers and formation of new islands and bars in historic times; other historic evidence; successive growth of marsh plants, bushes, poplars, spruces, etc., as the land rises; beach dwellings and other shore works of the Eskimos now elevated to considerable heights; fresh character of fossil shells, etc., in clays and sands; deep water deposits elevated above the sea level at comparatively recent periods; similar phenomena on the eastern coast of the Labrador peninsula; bones of whales, etc., on elevated ground in Hudson Strait; raised terraces and beaches in the northwestern part of Hudson Bay; general shoaling of the water, extension of shores and enlargement of islands.

The paper was discussed by one or two speakers without, however, bringing out material points.

Possible Depth of Mining and Boring. ALFRED C. LANE, Houghton, Mich.

This paper discussed some of the difficulties in deep mining, especially the rise in temperature, and considered what the most favorable circumstances are and the most effective way of overcoming the difficulties, and how far we may expect that the earth's crust will be penetrated. The expenses were plotted as the abscissas of a curve of which the depths furnished the ordinates. Ten thousand feet appeared to be approximately the limit. The depths of some of the shafts in the copper country of Lake Superior were cited, and the hope was expressed that, when the ultimate practical depth has been reached, a purely scientific bore hole be started at the bottom, before the shaft is abandoned, and sent down several thousand feet further. In the discussion that followed special attention was paid to the rate of the increase of temperature as we go down. One speaker cited the recent results published by Alexander Agassiz in the American Journal of Science, December, 1895, p. 503, as 1° F. for each 223.7 feet down to 4,580. For this result a mean rock temperature at 105 feet of 59° F. is used, whereas the mean annual temperature of Calumet is about 40°, and practically this temperature of 40° has been determined at slight depths in other neighboring mines. A mean annual temperature of 59° F. is not met north of Kentucky and this fact makes corroboration desirable before important inferences are based on the later and excessively low gradients.

Notes on Glaciers. HARRY FIELDING REID, Baltimore, Md.

Dr. Reid referred, in opening the paper, to his recent efforts to get reliable data on the variations of American glaciers. Mr. Willis reports that the Pyallup glacier on Mt. Rainier had retreated 200–300 yards and the Carbon glacier 100–200 feet. In British Columbia the Illiciliwaet was observed to recede in 1890 and 1894. Dr. Reid then gave a most interest-

ing analysis of the accumulation and motion of glaciers. He distinguished the region of accumulation of snow in excess of melting as the reservoir, and the region of melting in excess of accumulation as the dissipator; the border line is the nêvé line. By assuming cross-sections at various points, the relative velocities of movement were worked out on the basis of mechanics. The same was done for a glacier which spreads from a center in all directions. The progress of the same layer of snow was then traced from reservoir to dissipator and parallel lines of motion for the individual parts were established, the névé line furnishing a middle line. It was then shown that the original stratification plane as indicated by debris would at the end of the journey cut these lines of motion and would emerge with a high dip, a fact already observed on some glaciers. The topic of the variation in the advance and retreat of glaciers was discussed and the several explanations were analyzed in detail. The paper was discussed by G. Frederick Wright and R. D. Salisbury, the latter mentioning that the thin fronts of Greenland glaciers showed the upward tendency of stratification planes, but that thick fronts lacked it. The Society then adjourned until the following day.

In the evening about sixty Fellows dined together, with President Shaler and Professor Emerson acting jointly as toastmasters, and listened to some amusing speeches by several members.

On reassembling Saturday morning the reading of papers was at once resumed.

The Relation between Ice Lobes South from the Wisconsin Driftless Area. Frank Leverett, Denmark, Iowa.

Instead of a coalescence of ice lobes from the east and the west sides of the Driftless Area in the drift-covered district to the south there was an invasion and withdrawal of one lobe (the western) before the other reached its culmination. The eastern lobe encroached upon territory previously glaciated by the western, depositing a distinct sheet of drift and forming at its western limits a well-defined morainic ridge. There appears to have been a period of considerable length between the withdrawal of the western lobe and the culmination of the eastern.

Subsequently, however, there was a readvance of the lobe on the west into northeastern Iowa, and this readvance appears to have been contemporaneous with the nearly complete occupancy of northwestern Illinois by the eastern ice lobe. It seems not improbable that the ice lobes were then for a brief period coalesced for a short distance about the south border of the Driftless Area. Evidence of complete coalescence, however, is not decisive so far as yet discovered.

These developments serve to throw light upon the cause for the scarcity of lacustrine deposits in the Driftless Area. They show that there was at most but a brief period in which the southward drainage of the Driftless Area was completely obstructed by the ice sheet.

By means of maps it was brought out that there were probably two centers of accumulation—one, the earlier, toward the northwest; and the other, the later, in the Labradorian heights. In the discussion R. D. Salisbury remarked the great complexity of the glacial period, and G. Frederick Wright, while admitting the minor complexity, emphasized its essential grand unity. President Shaler called attention to the importance of demonstrating the progress of glaciation from west to east, because if we can establish the sequence of events, we have advanced a long way toward discovering their cause.

The Loess of Western Illinois and Southeastern Iowa. Frank Leverett, Denmark, Iowa.

The north border of the loess both in

western Illinois and eastern Iowa appears to have been determined by the ice sheet. The loess is apparently an apron of silt spread out to the south by water issuing from the ice sheet. It is loose textured at the north and becomes finer textured toward the south, showing a decrease in the strength of depositing currents. The wide extent of loess over the uplands has led to a consideration of the influence of wind as well as water in its distribution. It is thought that wind-deposited loess may be distinguished from that which is water deposited. The wide extent, however, appears to be due to water distribution rather than wind. Wind action apparently came into force subsequent to the water distribution and is of minor importance.

G. K. Gilbert in discussion expressed his gratification at hearing of 'loess' the rock, instead of exclusively of 'the loess,' the peculiar geological formation. He cited a case in eastern Colorado, along the Missouri Pacific Railroad, where loess had gathered on the leeward side of sand dunes. B. K. Emerson spoke of the aqueous loess of the Hadley meadows in Massachusetts from the annual floods of the Connecticut river, and the eolian loess on the neighboring hills.

High-level Terraces of the Middle Ohio and its Tributaries. G. FREDERICK WRIGHT, Oberlin, O.

This paper embodies the results of the writer's personal observations during the summer and autumn of 1895 on the terraces of the Ohio river, between Steubenville and Marietta, and on the Kentucky river, between High Bridge and Boonetown. The presence of beds of granitic gravel and of isolated boulders of this rock, *i. e.*, of a rock that must have reached its resting place by the agency of ice from the north, in the country adjacent to the Ohio was remarked. An elevated and extensive bed of sand on the southwest end of a large island between St. Mary's and Newport was instanced as indicating peculiar and as yet not well explained conditions of high water and of a change in the river channel.

I. C. White in discussion explained the large island as in large part caused by a preglacial channel of Middle Island creek, which enters the Ohio at St. Mary's, directly athwart its course and through a gorge that is continued in the abandoned channel that now forms the island's northwest side. He also stated that pebbles often reached exceptional heights on the hills because the farmers use sand with some contained gravel for bedding in their stables and consequently scatter it over their fields at all altitudes. President Shaler also cited the custom among the Indians of cooking with heated boulders, and as the local limestones and sandstones were of no value for this purpose they often brought granitic boulders from a distance. Prof. Wright, however, cited boulders of 4,000 pounds, which manifestly could not be explained in these ways. A. Heilprin then mentioned the polished and grooved rocks of South Africa which had been regarded as glaciated. More careful investigation however has shown that the polishing is due to the habit of elephants to formerly resort to them and roll and scrape on them, and that the grooves are due to the rubbing of their tusks. F. Leverett corroborated the observations of Prof. Wright in the northern part of the area.

Four Great Kame Areas of Western New York. H. L. FAIRCHILD, Rochester, N. Y.

This paper described three kame areas south of Irondequoit bay and one south of Sodus bay. These are remarkable for extent and quantity of material, as well as for location and altitude; one of them having gravel hills 400 feet high and furnishing the highest altitude of ground in western New

York, north of the Devonian plateau. The geographical location and extent of the kames were shown by a large map and the first three were named, the Irondequoit, the Mendon and the Victor; the last was called the Junius. Excellent photographs were passed around in further illustration.

Paleozoic Terranes in the Connecticut Valley. C. H. Hitchcock, Hanover, N. H.

The author has made occasional studies of the rocks along the upper Connecticut valley since his official connection with state surveys, and thinks there are good reasons for revising some of the conclusions of the New Hampshire report. Some of the points are: 1. The existence of two bands of argillite; one below and the other above the calciferous mica schist. 2. The hornblende schist of the neighborhood of Hanover is a laccolite. 3. The protogene gniesses of Hanover and of North Lisbon are igneous. 4. With the views now entertained of the igneous origin of the protogene, hornblende schist, foliated diorites and diabases, a new arrangement of the stratified fossiliferous rocks of Littleton, N. H., is suggested. The points were illustrated by geological maps. The older argillite cited under 1, above, was referred to the Upper Silurian, and the later one to a subsequent but not definitely determined period. The discovery of contact effects along the junction of the hornblende schist of 2, with the argillites and mica schists is additional ground for the later conclusion. In support of 3, it was shown that the gneiss contains inclusions of the schists. Under 4 the metamorphic rocks, in association with fossiliferous Niagara limestone at Littleton, are now regarded as post-Niagara, not Cambrian. B. K. Emerson, in discussion, remarked that this revision placed the geological structure in harmony with the results now attained in Massachusetts on the south.

The next paper was by C. Willard Hayes on 'The Devonian Formations of the Southern Appalachians.' Mr. Hayes gave a generalized section of the Devonian as follows: An upper and very persistent layer, 8 inches to 24 inches thick, of a green sandstone, with phosphatic nodules and shreds of volcanic glass, feldspars, etc., such as to indicate a volcanic tuff. Below this comes black shale, 0–12 ft., and not always present. The bottom stratum is a ferruginous conglomerate or sandstone 0–6 ft., and contains the recently discovered phosphate beds of Tennessee. Attempts to explain the thin character or actual absence of the Devonian over great areas have been made as follows.

1. The region was a deep sea bottom, lacking sediments.

2. It was a region of shallow waters whose entering streams were without sediments.

3. It was a land area.

4. It was a shallow sea without sediments and with swift but clear currents, like the Gulf stream region of the West Indies.

The speaker believed, however, that such sediment as was distributed came in large part in currents from the northeast, and that another current came from the southeast and moved northwest, rounding the Cincinnati arch. D. W. Langdon raised the point of the relations of the Devonian to the Helderberg limestones in southwest Virginia, and the same point was discussed by the author and by J. J. Stevenson. Messrs. Keith, Van Hise and H. S. Williams also took part in the discussion.

Notes on the Relations of the Lower Members of the Coastal Plain Series in South Carolina. N. H. Darton, Washington, D. C.

The formations below the Eocene buhrstone which were included in the Eocene by Tuomey have been found to be Potomac. Some of their features and their relations to the marine Cretaceous were described.

Resumé of General Stratigraphic Relations in the Atlantic Coastal Plain from New Jersey to South Carolina. N. H. DARTON, Washington, D. C.

A series of sections were exhibited to show the distribution and variations of the principal coastal plain formations, and there were pointed out some bearings of the features on the geologic history. The data are based largely on the author's studies, but they also combine a resumé of some observations of others.

Both these papers were read together and were illustrated by figured geological sections based on the recently acquired records of artesian wells. There were five, viz: Philadelphia to Wildwood, N. J.; Washington to Crisfield, Md.; Richmond to Norfolk; Orangeburg to Charleston; Aikin to Beaufort, S. C. They illustrated the relations of the granitic Archean rocks to the Jurassic Potomac formation, the Cretaceous Magothy and Severn, the Eocene Pamunkey and the Miocene Chesapeake. Paleontologic details would have made the first paper clearer. An interesting and important point is the discovery of Newark sandstone in a deep well at Florence, S. C., far south of our previously recorded locations. D. W. Langdon, in discussion, raised the paleontologic point referred to above.

The last paper read was by Arthur Keith, '*Some Stages of Appalachian Erosion.*' The paper was a general review of the drainage systems of the area in question, and of the factors which had contributed to develop its present topography.

C. H. Hitchcock then presented a resolution of thanks to the local committee and to the authorities of the University of Pennsylvania for their hospitality and many courtesies. It was unanimously passed and then the eighth annual meeting of the Society adjourned.

The following papers, although announced in the program, were not read either because their authors were absent from the meeting, or because they were not present when the papers were reached in regular order:

The Natchez Formations. T. C. CHAMBERLIN.

Disintegration and Decomposition of Diabase at Medford, Mass. GEORGE P. MERRILL, Washington D. C.

On the Geographic Relations of the Granites and Porphyries in the Eastern Part of the Ozarks. CHARLES R. KEYES, Jefferson City, Mo.

The Cerrillos Coal Field of New Mexico. JOHN J. STEVENSON, New York, N. Y.

Pre-glacial and Post-glacial Channels of the Cuyahoga and Rocky Rivers. WARREN UPHAM, St. Paul, Minn.

J. F. KEMP.

COLUMBIA COLLEGE.

AMERICAN MORPHOLOGICAL SOCIETY.

OF the three sessions held by the Morphological Society the first was mainly devoted to business questions, of which the most important related to the plan of affiliation with the Society of Naturalists brought forward at the meeting of 1894. This plan was rejected on the ground that most of the other societies had taken action adverse to it. It was, however, recommended that coöperative action by all the societies should be urged in order to assure a common place and time of meeting. A resolution was adopted endorsing the action of the Smithsonian Institution in maintaining an American table at the Zoölogical Station at Naples, and expressing the earnest hope of the Society that the table may be continued in order that the unrivalled facilities of the Station may be open to American investigators in the future as in the past.

The scientific program was as follows:

Friday, December 27, 1895.

C. S. Minot: *Panplasm.*

B. B. Griffin: *The History of the Centrosome in Thalassema.*

E. B. Wilson: *The Centrosome in its Relation to Fixing and Staining Agents.*

T. H. Morgan: *The Production of Artificial Archoplasmic Centers.*

F. R. Lillie: *On the Smallest Parts of Stentor Capable of Regeneration.*

E. G. Conklin: *Cell-size and Body-size.*

T. H. Morgan: *The Development of Isolated Blastomeres of the Egg of Amphioxus.*

G. W. Field: *Spermatogenesis of Amphioxus.* (By title only.)

Saturday, December 28, 1895.

Bashford Dean: *Gastrulation of Teleosts.*

W. A. Locy: *Further Evidence of Primitive Metamerism in Birds and Amphibia.* (By title only.)

G. H. Parker: *Pigment Changes in the Eye of Palæmonetes.*

G. H. Parker: *Reaction of Metridium to Food and Other Substances.*

C. W. Stiles: *Some Points in the Anatomy of Anoplocephaline Cestodes.*

R. P. Bigelow: *Development of Cassiopea from Buds.*

A novel feature of the scientific sessions was the grouping of allied papers, a plan which proved very successful as a stimulus to general discussion. The first session was entirely taken up with papers on protoplasm, the cell and the closely related subject of experimental embryology. Professor Minot, of Harvard, opened with a paper on 'Panplasm,' in which the nature of protoplasmic organization was critically discussed. The doctrine now advocated by so many cytologists, that protoplasm is compounded of elementary organic units, such as the 'pangens of de Vries, the 'idioblasts' of Hertwig, the 'biophores' of Weismann, etc., was rejected *in toto*. Protoplasm, he maintained, is a mixture of substances, not of self-propagating units; and the attempts to distinguish between living substance and the 'lifeless' substances associated with it are, in the main, wide of the mark. The entire substance of the cell, the 'panplasm,' is the only real unit and must be regarded as a whole.

Mr. Branley B. Griffin (Columbia) described the fertilization of the egg and the history of the centrosome in the gephyrean worm, *Thalassema*. As in echinoderms and many other forms there is no 'Quadrille of Centers.' The centrosome of fertilization is derived from the supermatozoön and the egg-centrosome degenerates after the formation of the polar bodies. The sperm-centrosome may be continuously traced, as a distinct black granule, throughout all the stages of fertilization into the cleavage-stages, and at no time disappears. The centrosome of the first spindle becomes double at a very early period and passes to the outer periphery of the centrosphere, where a minute amphiaster is formed on each side as early as the mid-anaphase of the first cleavage. This amphiaster is the precocious preparation for the second cleavage.

Prof. E. B. Wilson (Columbia) called attention to the fact that the existing confusion regarding the centrosome and attraction sphere is probably due in part to the varying effects of reagents on these structures. In *Thalassema*, as shown by his own observations and those of the preceding speaker, the centrosome appears as a minute black granule after hardening with sublimate or picro-acetic and staining with iron hæmatoxylin. After sublimate-acetic neither centrosomes nor deutoplasm spheres stain, though the general fixation is not inferior to that yielded by the other methods. This suggests the possibility that in *Toxopneustes*, likewise, the sublimate-acetic mixture may cause the centrosomes to disappear from view. It was however recalled that in certain stages of this same form they are not shown after other reagents, such as sublimate and Hermann's fluid; that they are perfectly shown in the maturation spindles of the starfish after sublimate-acetic, but afterwards disappear; and that Hill's ob-

servations (sublimate-acetic) and Boveri's (picro-acetic) differ both from each other and from the speaker's. The whole subject, therefore, requires further study with special reference to the technique.

The following paper by Prof. T. H. Morgan (Bryn Mawr), on the production of artificial archoplasmic centers, was of special interest and led to much discussion. Unfertilized, as well as fertilized, eggs of sea urchins and ascidians, when treated with salt solutions of a certain concentration, become filled with numerous asters which show in many respects a close resemblance to the normal asters of dividing cells, and may contain a body similar to a centrosome. This cannot be due to polyspermy, because the eggs contain but a single nucleus, and for other reasons. Prof. Morgan is inclined to regard the asters as new formations produced by a rearrangement of the protoplasm under abnormal conditions. In a second paper Prof. Morgan described the development of dwarf larvæ from isolated blastomeres of *Amphioxus*, with reference to the numerical relations of the cells. Half-larvæ and quarter-larvæ always possess a number of cells not precisely one-half or one-quarter the normal number of the full sized animal at the same stage but somewhat greater, and these partial larvæ show a marked tendency, not however fully carried out, to use the same number of cells in the formation of their organs as that used by the full sized larva. Thus the notochord is always formed of three cells (in cross-section) in larvæ of all sizes. These results show that there is an inherited tendency to produce a definite number of cells for the formation of particular organs, irrespective of the total size of the embryo.

The paper of Prof. Conklin (University of Pennsylvania), on 'Cell-size and Body-size,' discussed a nearly related question from a different point of view. Observations on the marine gasteropod, *Crepidula*, show that adult animals vary enormously in size, the dwarfs having in some cases not more than $\frac{1}{27}$ the volume of the giants. The eggs are, however, always of the same size and are proportional in number to the size of the adult. Microscopical study of the tissues shows that the same is true of the tissue cells. Measurements of cells from various tissues, representing derivatives of all the germ layers (ectodermal epithelia, kidney cells, liver cells, alimentary epithelia, etc.), show that they are not perceptibly smaller in the dwarfs than in the giants. Prof. Conklin, therefore, concludes that body size is not dependent on cell size, but on the total *number* of cells, a result which agrees with that reached by botanists, but differs somewhat from that obtained through a study of the nervous system in higher animals. His conclusion agrees only in a measure with Morgan's results on *Amphioxus;* for the latter indicate that the number of cells in dwarfs, while considerably less than in those of normal individuals, is not strictly proportional to the body size.

Dr. Lillie (University of Michigan) presented the results of a research on the limit of size in the regeneration of *Stentor*. These animals, like eggs, may be shaken into fragments of various sizes, among which may be found both nucleated and non-nucleated pieces and also naked nuclear fragments. Only such fragments as contain both cytoplasm and nuclear substance are capable of regeneration. Complete regeneration may take place in a fragment containing only 1-27 the bulk of an entire animal. Smaller fragments cannot regenerate. This result is remarkably near to that of Boveri, who has found that the limit of size in egg fragments capable of producing a complete larva (in sea urchins) is approximately 1-20 the volume of the entire egg.

The second session was devoted in the main to papers on anatomy and develop-

ment, varied by physiological contributions from Dr. Parker.

Dr. Dean (Columbia) discussed the gastrulation of teleosts from a comparative point of view, urging that a key to its interpretation must be sought in the development of ganoids. Lepidosteus, Acipenser and Amia form a progressive series culminating in the teleost, the length of the neural plate gradually increasing from 90° to more than 200°, the ventral lip of the blastopore becoming less clearly marked, and the neural plate becoming more and more concentrated towards the median plane. The following interpretation of the of the parts of the teleostean gastrula was adopted: dorsal and ventral lip of the blastopore as identified by Haeckel, Ryder, H. V. Wilson and others; 'ventral mesoblast' of H. V. Wilson as entoblast; Kupffer's vesicle as the notch under the dorsal lip of the blastopore, caused mechanically in the growth of the Randwulst; periblast as the highly differentiated outer layer of the yolk mass, which enables the enclosing growth of the blastoderm, yet preserves in a most perfect way its incremental relations with the adjacent tissues of the embryo. In view of the presence of medullary folds in Lepidosteus and Acipenser, rudimentary in the former, perfect in the latter, the solid neural plate of the embryonic Teleost must be regarded as a secondary condition, due to the mechanical needs of the embryo in its precocious growth.

Dr. Parker's (Harvard) first paper considered the pigment changes in the eye of the shrimp *Palæmonetes* with especial reference to the nature of the reflex-action involved.* The pigment-changes called forth by the action of light take place in the typical manner in animals after section of the optic nerve, showing that they are not determined by a reflex center in the cerebral ganglia, but by a local action which may be due to the direct action of light on the pigment cells.

In his second paper Dr. Parker gave an account of experiments on sea anemones which led to interesting results. These animals respond in a definite manner either to solid or dissolved food matters, and the sense by which they are perceived resides in the tentacles, the oral disc and the lips of the mouth. Food is taken in through the action of cilia covering the tentacles and the entire oral region. Those of the lips and œsophagus work inwards; those of the tentacles work outwards towards the lips. If nutritious substances are placed on the tentacles the latter bend inwards towards the mouth, into which the food is therefore swept by the cilia; innutritious bodies, on the other hand, cause the tentacles to be extended so that such bodies are carried out to the tips and thrown off. The most interesting results relate to the reversal of the ciliary action that occurs under certain conditions. Inert substances, such as carmine, may be at first swept into the mouth, but are afterwards thrown out by a reversed action of the œsophageal cilia. The action of the cilia is therefore under the control of the animal, which is moreover capable of certain degree of education. If animals be fed with fragments of meat and pieces of paper soaked in meat juice, both are at first taken into the stomach, but the paper fragments are afterwards thrown out. After a number of trials (seventeen or more) the animal learns to discriminate, the paper being rejected and the meat swallowed. Their memory is however short lived, for on the following day the lesson must be learned anew.

Dr. Stiles, of Washington, discussed a number of new points in the anatomy of tape worms, and exhibited a large number of plates of new and little-known species. He

* Unfortunately an adequate review of this paper cannot be given.

distributed specimens of Demodex and Coccidium parasites for class work, and made a plea for a more adequate study of parasites in college work as a preparation for medical studies.

Dr. Bigelow (Institute of Technology) described observations on the budding of the scyphistoma of Cassiopea, which tend to uphold the views of Claus and are opposed to those of Götte. The bud forms in the plane of one of the principal radii as an evagination of both layers. It is set free as a ciliated free-swimming planula and the mouth is afterwards developed, not at the distal, but the proximal or basal end. No stomodæal invagination of ectoderm occurs, and the proboscis is therefore lined by entoderm. The gastric pouches do not arise as evaginations, but by the inward growth of septa from the mesoglœa. The first tentacles to be formed are the four per-radial; the numbers in following stages are normally 8, 16 and 32.

CURRENT NOTES ON PHYSIOGRAPHY.

TOPOGRAPHICAL MAP OF ITALY.

FOUR sheets (Nos. 7, 18, 33, 46) of the topographical map of Italy—1 : 100,000—published recently by the *Istituto geografico militare*, cover a stretch of country from the crest of the Alps in the Bernina group, with many glaciers, to the northern side of the plain of the Po, where the river Adda emerges from the foothills. The northernmost sheet includes the divide between the Maira and the Inn, separating the waters of the Po and the Danube; here the northward migration of the divide, as described by Heim, has caused the formation of the little lakes of the Engadine (Die Seen des Oberengadin, Jahrb. Schw. Alpenklub, XV, 429); certain back-handed branches of the Maira, once tributaries of the Inn, are clearly shown. The second sheet exhibits the deep longitudinal valley of the Adda about Sondrio, 2,000 meters beneath the mountains on either side, the stream being continually thrown to one or the other side of its well-graded floor by the large alluvial fans of lateral streams. The two southern sheets show a number of torrential streams with tangled channels flowing southward in almost parallel courses across the great alluvial plain, whose slope is here about twenty feet to the mile; the banks of the streams often being somewhat higher than the ground between them, and thus indicating that portions of the plain consist of numerous alluvial fans, confluent laterally; a form very well adapted to the construction of the numerous canals that are led from the streams to the fields. The maps being printed in a single black impression, it is often difficult to distinguish streams and canals from roads.

MAP OF THE GERMAN EMPIRE. 1 : 1,000,000.

SEVERAL interesting features appear on certain sheets of the German topographical map, published last year and this. One of the broad dry valleys cut in the Piedmont slope of Bavaria by some extinct glacial streams, is exhibited on the Mindelsheim (636) and Burgau (622) sheets. The tangled channel of the torrential Inn and a glimpse of the shallow canyon of the Danube below Passau are found on the Neuhaus-a-Inn, sheet (628). Further up stream the Inn manifests a peculiarly strong tendency to follow the right-hand side of its broad valley floor, here at least two miles from side to side (Landau sheet 612). The great north-facing Jurassic escarpment of the Swabian Alp in Wurtemburg, is in part shown on the Aalen sheet (592), east of Stuttgart; the location of Aalen at the northern base of the escarpment, and of the road and railroad southward across the Alp from it, depend on the occurrence there of one of the several notches in the rim of the upland, representing the trough of a beheaded river, whose winding lower course

on the southern slope of the Alp gradually gathers a little stream, the Brenz, as appears on the next sheet (607). Railroads crossing the Alp at Geislingen and Ebingen. further southwest, are similarly located; thus exemplifying the principle announced by Oldham (SCIENCE, II., 688). There are three sheets, 559, 574, and 590, of somewhat earlier issue on which the deep-incised meanders of the Neckar and its abandoned loops are beautifully portrayed.

TOPOGRAPHICAL MAP OF DENMARK, 1:100,000.

THE beautiful sheets of this series, printed in six colors for different soils and cultures, with most delicate expression, have comparatively little of importance to show of the flat inland topography, but exhibit many interesting coastal outlines.

On the inland waters of Limfjord (Lögstör sheet), the shore frequently swings in curves of small radius or projects in fine sharp spits, appropriate to the easy turning of litoral currents of small volume and strength; but on the exposed coast of the west and north, facing on North sea, the shore is modulated in long sweeping curves, adjusted to the slow swinging of the larger bodies of water there in movement. The Thisted sheet and others of previous issue as far north as Skagen, contain many examples of this kind. This recalls the different scale of meanders adopted by small brooks and large rivers. The *offset*, or outstanding position of one stretch of shoreline with respect to the next, may be taken to indicate the up-stream portion of the prevailing litoral current; this feature also being neatly shown on the North sea coast of the Thisted sheet, where the current seems to come from the southwest. Along the eastern coast, a north-to-south movement is implied by the offset of the coast north of the outlet of Limfjord compared to that on the south (Aalborg sheet); and this is clearly confirmed by the long sandbar of Stensnæs near by, tangentially overlapping southward (Frederikshavn sheet).

W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

THE ETHNOLOGY OF MADAGASCAR.

THE occupation of the island of Madagascar by the French, in the year 1895, led to the publication of a number of articles on the history, languages and ethnology of the island. The two which I have found most instructive are one in the *Revue Scientifique*, by Prof. E. T. Hamy, 'Les Races Humaines de Madagascar,' and one in the Journal of the Anthropological Institute, by J. T. Last, 'on the languages of Madagascar.'

It is gratifying to find that both agree on the main question involved—the relationship of the oldest historic inhabitants of the island. This is distinctly *not* African, as many have supposed; nor is it Arabic, as some have argued; but it is 'Indonesian,' or 'Malayo-Polynesian,' that is, the earliest known possessors of the soil came from Malasia and Melanesia, and belonged to the so-called 'brown race.' Their language to this day is strongly affined to the Malayan; and this is true not merely of the dominant Hovas, but of the mass of the people. For about a thousand years, however, there has been a constant importation of negroes from Africa, and an arrival of colonists from the northern Semites; and these two admixtures have deeply tinged the blood of the stock.

PRE-GLACIAL MAN IN ENGLAND.

PROFESSOR Joseph Prestwich has lately published a volume entitled 'Collected Papers on some Controverted Questions in Geology' (London, 1895). Two of these papers have a deep interest for the anthropologist, one on the glacial period with reference to the antiquity of man in western

Europe; the other on the primitive flint implements found in the gravels on the chalk plateau of Kent. Although they both appeared before, they have now been published with additions.

Their conclusions may be briefly stated. The author thinks man probably lived on the Thames and the Somme in pre-glacial times, a period he would put at 30,000 to 50,000 years ago. The worked flints of the plateau—generally small, extremely rude and never 'compound' (*i. e.*, used with handles)—he attributes to these early men. Numerous illustrations of them are inserted, from which their artificial character is evident. The author's discussion of the questions involved is able and satifying.

D. G. BRINTON.

SCIENTIFIC NOTES AND NEWS.

ASTRONOMICAL.

DR. SEE, of the University of Chicago, announced in the *Astronomical Journal* of November 13th that the well-known binary star 70 Ophiuchi exhibited anomalies in its motion which could only be explained on the supposition that there is a non-luminous perturbing body in the system. This matter acquires especial interest from the fact that this star is one of those binaries for which we possess a really accurate orbit. The theory of this star's motion published recently by Prof. Schur in the *Astronomische Nachrichten* is perhaps the most elaborate investigation of a double star orbit yet made. It was therefore very surprising to hear that the mean of thirteen nights' observations by three American observers gave the error of Schur's ephemeris as nearly five degrees in position angle, although only three years had elapsed since the computation of his orbit. The matter cannot yet be regarded as settled, for Prof. Schur shows in the last number of the *Astronomische Nachrichten* that the American observations are not in agreement with his own most recent heliometer observations, which agree very closely with his ephemeris. On the other hand, they are supported by the most recent observations at Paris by M. Callandreau, though these are in disaccord with those of Herr Ebell at Berlin. It is to be hoped that numerous observations of this most interesting star will be made in the near future. H. J.

PROF. E. C. PICKERING announces in Circular No. 4 from the Harvard College Observatory that a new star in the constellation Centaurus was found by Mrs. Fleming on December 12, 1895, from an examination of the Draper Memorial photographs. Its approximate position for 1900 is in R. A. $13^h\ 34^m$ .3, Dec. $-31°\ 8'$. Attention was called to it from the peculiarity of the spectrum on Plate B 14151, taken at Arequipa on July 18, 1895, with the Bache Telescope, exposure 52m. The spectrum resembles that of the nebula surrounding 30 Doradus, and also that of the star A. G. C. 20937, and is unlike that of an ordinary nebula or of the new stars in Auriga, Norma and Carina. This object is very near the nebula N. G. C. 5253, which follows $1^s.28$, and is north $23''$. No trace of it can be found on 55 plates taken from May 21, 1889, to June 14, 1895, inclusive. On July 8, 1895, it appeared on a chart plate, B 13965, and its magnitude was 7.2. On Plate B 10472 taken July 10, 1895, its magnitude was also 7.2. On December 16, 1895, a faint photographic image of it, magnitude 10.9, was obtained with the 11-inch Draper Telescope, although it was very low, faint and near the sun. On this date, and on December 19, it was also seen by Mr. O. C. Wendell with the 15-inch Equatorial as a star of about the eleventh magnitude. An examination with a prism showed that the spectrum was monochromatic, and closely resembled that of the adjacent nebula. Although the spectrum is unlike those of the new stars in Auriga, Norma and Carina, yet this object is like them in other respects. All were very faint or invisible for several years preceding their first known appearance. They suddenly attained their full brightness and soon began to fade. Like the new stars in Cygnus, Auriga and Norma, this star appears to have changed into a gaseous nebula.

ANTARCTIC EXPLORATION.

The Century for January contains an article by Mr. Borchgrevink describing 'The First Landing on the Antarctic Continent,' which is

the only account of his experiences which he has contributed for publication. He writes that he believes that Cape Adare is the very place where a future scientific expedition might stop safely even during the winter months. From this spot several accessible spurs lead up to the top of the cape, and from there a gentle slope runs on to the great plateau of Victoria Land. The presence of the penguin colony, their undisturbed old nests, the appearance of dead seals (which were preserved like Egyptian mummies, and must have lain there for years), the vegetation to the rocks, and lastly the flat table of the cape above, all indicate that here is a place where the powers of the Antarctic Circle do not display the whole severity of their forces. Neither ice nor volcanoes seemed to have raged on the peninsula at Cape Adare, and a future scientific expedition might well choose that place as a center of operations. On this particular spot there is ample space for house, tents and provisions.

Mr. Borchgrevink offers to be the leader of a party to be landed either on the pack or on the mainland near Colman Island. From there he would work toward the south magnetic pole, calculated to be in latitude 75° 5′, longitude 150° E. Should the party succeed in penetrating so far into the continent, the course should, if possible, be laid for Cape Adare, there to join the main body of the expedition. As to the zoölogical results of future researches, great discoveries may be expected. It would indeed be remarkable if on the unexplored Victoria continent, which probably extends over an area of 4,000,000 square miles, there should not be found animal life hitherto unknown in the southern hemisphere. It is of course a possibility that the unknown land around the axis of rotation might be found to consist of islands joined only by perpetual ice and snow; but the appearance of the land, the color of the water, with its soundings, in addition to the movements of the Antarctic ice, point to the existence of a mass of land much more extensive than a mere group of islands.

GENERAL.

Nature has in recent numbers urged the need of employing scientific experts and scientific methods in the public service. Twenty years ago a Royal Commission urgently advised the appointment of a Ministry and Council of Science. Its recommendations have never been carried into effect, and *Nature* deplores the lack of men scientifically trained and of proved ability and originality in the government departments. The United States government and the separate States undoubtedly do more for the advancement of education and science than does any other country, yet the administration compares unfavorably not only with France, where M. Berthelot, the great chemist, is Minister of Foreign Affairs, but also with Great Britain where the Cabinet includes men such as Lord Salisbury, Mr. Balfour and the Duke of Devonshire, who take sincere and intelligent interest in the advancement of science.

The Lecomte prize (50,000 fr.) of the Paris Academy of Sciences has been awarded to Prof. Ramsay and Lord Rayleigh for the discovery of Argon. The Valz prize has been awarded to Mr. W. F. Denning for astronomical work. The Albert Lévy prize (50,000 fr.) of the Paris Academy of Medicine has been awarded to Dr. Behring and Dr. Roux for the discovery of the serum treatment of diphtheria.

The *British Medical Journal* learns that the Calcutta municipality has decided that Dr. Haffkine's anti-cholera inoculation experiments are to be continued there for another year, and have assigned a grant of 7,500 rupees for this purpose.

Mr. Frank M. Chapman, of the American Museum of Natural History, will give the following lectures, 'On Birds, their Habits and Instincts,' under the auspices of Columbia College, in the Academy of Medicine, New York: January 7th, 'Distribution and Migration;' January 14, 'Sexual Relationships and Nesting Habits;' January 28, 'Color: its Nature and Uses;' February 4, 'Modification of Structure by Habit.'

The Chief of the Weather Bureau, Mr. Willis L. Moore, has answered an inquiry from the *Scientific American*, to the effect that the department is considering the feasibility of using weather forecasts as cancellation stamps in the post-office.

THE memoir of G. J. Romanes, edited by Mrs. Romanes, consists chiefly of letters, including an important correspondence with Darwin. It is expected that it will be published this month or in February.

WE learn from *Nature* that Prof. Bonney was presented with his portrait on December 16 by former geological students of the University of Cambridge and University College, London. Remarks were made by Mr. J. E. Marr, Miss Raisin and Prof. W. J. Sollas, and after the portrait had been unveiled Prof. Bonney replied.

THE annual election of officers of the Academy of Natural Sciences, Philadelphia, resulted in the election of Dr. Samuel G. Dixon to the presidency.

CABLEGRAMS state that a violent earthquake shock was felt on December 30, at Wiener, Neustadt, thirteen miles from Vienna.

THE *Weather-crop* Bulletin issued by the Department of Agriculture states that December, 1895, was generally slightly warmer than usual over the northern portions of the country, the average daily temperature excess being greatest in the Missouri Valley and northern New England, where it generally ranged from 3° to 6°. From the lower Ohio Valley northward to and including the southern portion of the upper Lake Region the average temperature for the month was about normal. The month was generally drier than usual in the Atlantic Coast and Gulf States, generally throughout the Rocky Mountain and Plateau districts and in California.

BEGINNING with the current number *The American Anthropologist* will be issued monthly instead of quarterly, and the subscription price will be reduced from $3 to $2 *per annum*. The number of pages in the volume will not be diminished. *The American Anthropologist* has during the eight years since it has been established printed a very large number of important papers on archæology, ethnology, folk-lore, sociology, philology and general anthropology, contributed by the leading American students of anthropology.

THE American Economic Association at its recent session in Indianapolis elected Henry C. Adams, of the University of Michigan, President, and Prof. Franklin H. Giddings, Columbia College, E. R. L. Gould, Johns Hopkins University and University of Chicago, and R. P. Falkner, University of Pennsylvania, Vice-Presidents.

THE *Medical News* has been removed from Philadelphia to New York, and Dr. Geo. M. Gould has retired from the editorship. The *Medical News* is one of the few weekly medical journals among the large number published in America that maintains a satisfactory scientific standard.

Nature announces that Prof. Sylvester has been elected an associate of the Brussels Academy of Sciences, Prof. Ray Lankester a corresponding member of the St. Petersburg Academy of Sciences, and Sir William Flower a foreign member of the Royal Swedish Academy of Sciences. The *Naturwissenschaftliche Rundschau* announces that Prof. R. Leuckhart has been elected an honorary member of the Paris Academy of Sciences.

THE *National Geographic Magazine* will hereafter be published on the first of each month under the editorship of Gen. A. W. Greely, Dr. W J McGee, Miss E. R. Scidmore and Mr. John Hyde. Subscriptions may be sent to the Secretary of the National Geographic Society, 1515 H street, Washington, D. C.

A REPORT issued from the Hydrographic Office describes the floating ice seen during 1892 and 1893 in the South Atlantic east of Cape Horn. It is said that the icebergs were of such size that they could not have been formed on small, low-lying islands, but only on a large continent of such height that great glaciers could be formed.

A CIRCULAR has been issued by several members of the Connecticut Academy of Arts and Sciences urging that more support be given to the Academy.

DR. JOHN RUSSELL HIND, the eminent British astronomer, died at London on December 23, in his seventy-third year. He was the author of important researches, especially on comets, and published works on this subject and on general astronomy. He was for many years superintendent of the *Nautical Almanac*. He had held the offices of Foreign Secretary and President of

the Royal Astronomical Society, and was a member of the most important scientific societies.

Alfred E. Beach died in New York on January 1st. He was one of the proprietors of the *Scientific American* and had made several important inventions, the best known of which is that of pneumatic tubes adjusted for carrying parcels and cars. The deaths are also announced of Robert F. Welsch, a writer of ichthyology; of Prof. A. P. Kostycher, of the Russian Agricultural Department, known for his investigations of soils and agricultural products; of Dr. A. V. Brunn, professor of anatomy in Rostock, and of Dr. Ludwig Teichmann, formerly professor of anatomy in Cracow.

UNIVERSITY AND EDUCATIONAL NEWS.

A bill to establish a National University at Washington has been introduced in the Senate and House of Representatives. It provides for its government a board of sixteen regents, with the President of the United States at its head, and a University Council, embracing the board and twelve educators, representing institutions belonging to different States.

A telegram to the *Evening Post* states that Elon College, in North Carolina, has received an endowment fund of $100,000 from a citizen of New York City, whose name is not at present made public.

President Mark W. Harrington, of the University of Washington, writes that he proposes to establish a department of terrestrial physics and geography in the University, and will be indebted to authors and publishers who will send to the University publications relating to these subjects.

The N. Y. *Medical Record* states that the Chicago College of Physicians and Surgeons is making arrangements to amalgamate itself with the University of Illinois

It is stated that Mrs. E. G. Kelly, of Chicago, will erect a chapel at a cost of $100,000 for the University of Chicago, as a memorial to her brother.

Dr. Dock, of the University of Michigan, has been appointed professor of pathology and bacteriology at Jefferson Medical College in Philadelphia.

We learn from the *American Geologist* that Prof. W. I. Blake, of New Haven, Conn., has accepted a professorship of geology and mining in the University of Arizona.

Dr. Hüfner, of Tübingen, has been called to the chair of physiological chemistry at Strassburg, vacant by the death of Hoppe-Seyler. Dr. Julius Bauschinger, of Munich, has been made associate professor of astronomy and head of the bureau of calculations in Berlin.

According to the *Academische Revue* the number of students matriculated at the University of Berlin is 5368: 486 in theology, 1812 in law, 1258 in medicine and 1812 in the philosophical faculty. There are 776 foreigners, 219 from America, 198 from Russia, 32 from Great Britain, 22 from France, etc. 40 women are admitted as auditors.

CORRESPONDENCE.

THE THEORY OF PROBABILITIES.

To the Editor of Science: It is easier to make true and misleading statements in the subject of probabilities than anywhere else. In this class I should be inclined to place the remark made by Professor Mendenhall, near the close of his article in your issue for December 20, regarding a deal in whist in which each of four players had all the cards of one suit. He says:

"The chances against any other particular distribution of the cards were just as great as against this and * * * the result of every deal of the cards is just as remarkable as this."

To the first part of this statement it is of course impossible to take exception; the second part seems to me misleading, if not untrue. To take another case. The chances of my tossing heads one hundred times running are precisely those of my tossing the particular succession of heads and tails that I do toss in any hundred throws of a coin. But is the former case no more *remarkable* than the latter? It is so much more remarkable that it at once arouses the

suspicion that I have committed fraud, while in the other case no one thinks of such a thing, unless—and here lies the gist of the whole matter—unless I or somebody else predicted exactly the succession of heads and tails that occurred. The remarkableness lies in the coincidence, not in the mere numerical probability of the configuration. Now the distribution of cards mentioned by Prof. Mendenhall and the succession of throws of a coin in which all are heads are both natural arrangements that readily occur to the mind, and hence are as striking subjects for coincidence as actually predicted arrangements. The fact is that an unpredicted arrangement is not judged 'remarkable,' because its probability is compared with that of *each and every* (individual) other possible arrangement, while with a predicted or other coinciding arrangement the comparison is between its probability and that of *any* other possible arrangement (no matter what). We may call the ratio of such comparison the 'ratio of surprise,' if you will. When heads turn up twice in succession the numerical probability ($\frac{1}{4}$) is precisely that of every other possible succession of heads and tails, but its ratio of surprise is $\frac{1}{4}+\frac{3}{4}=\frac{1}{3}$, whereas that of an arrangement not subject to comparison with some predicted or conspicuous arrangement is $\frac{1}{4}\div\frac{1}{4}=1$. The distribution of cards already mentioned belongs to the former class of configurations, and its 'ratio of surprise' is almost infinitesimal. It is therefore very remarkable, while an ordinary deal would not be so.

Professor Mendenhall of course does not need to be told of any of these things, but it seems worth while to call attention to what will seem, to the non-mathematical reader, a lack of correspondence between scientific and ordinary language—a thing to be avoided when possible.

ARTHUR E. BOSTWICK.

MONTCLAIR, N. J.

THE DEVELOPMENT OF THE EMBRYO OF PTERIS.

TO THE EDITOR OF SCIENCE—*Sir:* For two years I have been in correspondence with various biologists concerning a very evident error in Sedgwick and Wilson's Biology, and had I supposed it possible that the new edition would repeat such an error, I would have at least tried to prevent it. I refer to the oösphere quadrant developments as mentioned in the texts, old edition, bottom page 98 and top of page 99; New edition, top of page 140. He says in both places: 'The lower anterior quadrant as it undergoes further division grows out into the first root; the upper anterior quadrant in like manner gives rise to the rhizome and the first leaf.'

In a note below Fig. 80, in both editions he gives the truth in the matter but says: 'In *Pteris serrulata* the development is slightly (!) different.'

Where and how does the author obtain his authority for the statement as it stands in the text, making the root spring from the anterior quadrant?

Please call attention of botanists to this statement, and if any of them have obtained such a result with *Pteris aquilina*, let us hear from them and see their drawings.

F. D. KELSEY.

OBERLIN, OHIO, December 12, 1895.

TO THE EDITOR OF SCIENCE—*Sir:* Prof. Kelsey has our thanks for pointing out an obvious error in our description of the development of the embryo of *Pteris* from the oöspore. We can only regret that while corresponding 'for two years,' concerning the matter, 'with various biologists,' he did not include us among the number, as he might then, possibly, have saved himself some trouble and would have enabled us more promptly to correct the error.

THE AUTHORS OF THE *General Biology*.

LINE DRAWINGS OF BLUE PRINT.

THE method of making line drawings upon a blue print, mentioned by Mr. Slosson on page 893 of the last volume, is capable of being made very useful. I have used it for a number of years, and some of the results have appeared in the horticultural bulletins of the Cornell Experiment Station. I have no artistic ability, and yet one of these blue-print drawings was highly commended by an artist, who, fortunately, knew neither who the draughtsman was nor what was the method of its making!

L. H. BAILEY.

CORNELL UNIVERSITY.

SCIENTIFIC LITERATURE.

Charles Lyell and Modern Geology. By Prof. T. G. Bonney, F.R.S. *The Century Science Series.* Macmillan & Co., New York. 1895. Pp. 221, with index. $1.25.

The life of Charles Lyell, its fruition in the twelve editions of the Principles of Geology, and Lyell's influence on modern geology, form a subject worthy of the admirable treatment given it by Prof. Bonney. Brief as it is, this biography adequately spans his seventy-eight years, showing how he trained himself broadly in liberal knowledge and in science; how he developed a single purpose—'to put geology on a more sound and philosophical basis'—and how he pursued it so earnestly that Darwin could say: 'The science of geology is enormously indebted to Lyell—more so, as I believe, than to any other man who ever lived.'

Charles Lyell, born in 1797, the oldest son of Charles Lyell, sprang from a cultured family. His father was a student of literature and a lover of natural history, with a particular interest in entomology and botany. Thus the son inherited tastes which, developed by early associations as well as by Oxford training, fitted him for his life task as author and scientist. In spite of near sightedness, he was an accurate observer; he thought clearly; and his thought was no less clearly stated. The power of analysis and the power of expression, highly developed in combination, ever place their possessor among the leaders of men.

Lyell's studies in geology began in 1817 with lectures by Prof. Buckland, who was only thirteen years his senior and had been but recently appointed reader in geology at Oxford. Buckland roused enthusiasm for the science, but did not establish in his student's mind the verity of the diluvial theory. Ten years of study, rest for his eyes's sake, and travel on the Continent as well as in England, led Lyell from the profession of law, which he had entered upon, to the pursuit of geology. In 1828 he spent four months with Murchison in the volcanic district of central France, which Scrope had just made known to scientists. "The great flows of basalt—some fresh and intact, some only giant fragments of yet vaster masses—the broken cones of scoria, and the rounded hills of trachyte in Auvergne, supplied him with links between existing volcanoes and the huge masses of trap with which Scotland had made him familiar; while these basalt flows—modern in a geological sense, but carved and furrowed by the streams which still were flowing in their gorges—showed that rain and rivers were most potent, if not exclusive, agents in the excavation of valleys."

"The whole tour," wrote Lyell to his father, "has been rich, as I had anticipated (and in a manner which Murchison had not), in those analogies between existing nature and the effects of causes in remote eras which it will be the great object of my work to point out. I scarcely despair now, so much do these evidences of modern action increase upon us as we go south (towards the more recent volcanic seat of action), of *proving* the positive identity of the causes now operating with those of former times."

In 1829 the discussions were hot in the Geological Society between those who maintained the hypothesis of a universal deluge, and those who interpreted Nature through uniformity of modern and ancient causes. In April Lyell wrote to Dr. Mantell:

"A splendid meeting (at the Geological Society) last night, Sedgwick in the chair. Conybeare's paper on Valley of the Thames, directed against Messrs. Lyell and Murchison's former paper, was read in part. Buckland present to defend the 'Diluvialists.' * * * Greenough assisted us by making an ultra speech on the importance of modern causes. * * * Murchison and I fought stoutly, and Buckland was very piano. Conybeare's memoir is not strong by any means. He admits three deluges before the Noachian; and Buckland adds God knows how many *catastrophes* besides; so we have driven them out of the Mosaic record fairly."

How faintly, like blows of battle-axe on medieval armor, rings the echo of that controversy in this day! Yet it was the first and not the least of Lyell's services that he led the attack which drove that hypothesis of the theologians from its intrenched position.

Tried in debate and developed thereby, Lyell's ideas begot a purpose which absorbed his means, his time and his thought. That purpose is stated in the title of his book: 'Principles of Geology; being an Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation.' To this end he devoted the energies of a life singularly free from limitations and cares, such as ordinarily divert men from a single object.

The first volume of the Principles was written in the autumn of 1829, and published in the winter; the second appeared early in 1832, and the third in May, 1833. Five editions of the work had been issued by the spring of 1837. In 1838 the third volume was published separately as the 'Elements of Geology,' and the Principles, thus curtailed, passed through editions from the sixth to the eleventh during the author's lifetime, the twelfth being under way at the time of his death, in 1875.

Thus for forty-five years he pursued his purpose. There is danger in lifelong devotion to one hypothesis, but Lyell was armed against narrowing bias by his methods of observation and by the breadth of his mind. The hypothesis, which a small man would have spun to a vanishing thread, in Lyell's hands was forged into a chain of causality, binding past and present.

In accordance with one favorite saying of his: 'Go and see,' he travelled throughout western Europe and eastern America, searching always with painstaking care for facts. And obeying another principle, 'Prefer reason to authority,' (even when that authority was his own published conclusion), he kept his work abreast of the advance of geology, for which he had indicated the way.

Uniformitarianism did not originate with Lyell, but he became the great exponent of that principle. Not priority, but thoroughness, makes for reputation. Weighing the broader results of Lyell's studies, Prof. Bonney concludes: "We may be sure, that if Lyell were now living he would frankly recognize new facts, as soon as they were established, and would not shrink from any modification of his theory which these might demand. Great as were his services to geology, this, perhaps, is even greater—for the lesson applies to all sciences and to all seekers after knowledge—that his career, from first to last, was the manifestation of a judicial mind, of a noble spirit, raised far above all party passions and petty considerations, of an intellect great in itself, but greater still in its grand humility; that he was a man to whom truth was as the 'pearl of price,' worthy of the devotion and, if need be, the sacrifice of a life."

BAILEY WILLIS.

Die Gastropoden der Plankton-Expedition, von DR. H. SIMROTH. Kiel & Leipzig, Lipsius & Fischer. 1895. 4to., 206 pp., 22 pl.

The Plankton-Expedition, as many of our readers are aware, had for its object the study of pelagic life in the North Atlantic, and especially its distribution in depth; the drawing, as it were, of the bathymetric contours of oceanic life. The material thus gathered has been distributed among many naturalists for study, and a large number of essays have already been printed under the supervision of the general editor, Prof. Victor Hansen, of Kiel.

The latest contribution is by Prof. Heinrich Simroth, of Leipzig, already well known by numerous valuable studies of the mollusks, and especially by his editorship of the new edition of that part of Bronn's 'Thier-reichs' relating to the Mollusca. It comprises observations on larval and pelagic Gastropods, fully illustrated and of great interest.

After the reaction against the methods of descriptive biology based on superficial characters, which began about twenty-five or thirty years ago, so rich were the results derived from embryological and anatomical researches that the more hasty of the younger workers concluded in their enthusiasm that surface characters were of no value whatever; and this view was carried so far that we find one naturalist gravely arguing that the only proper basis for a classification of the Gastropods would be found in the number and arrangement of the ganglionic cells, which he had studied in half a dozen species of land snails. Even the better informed and more cautious biologists were led to doubt if the characters of the shell in mollusks would lend any aid to the study of the

evolution of the group. Fortunately, these views have proved illfounded, and a more minute and exhaustive study of shell characters in some groups has shown that valuable assistance in working out lines of development and the relations of different forms may be obtained by those who properly study the shell, its larval forms and dynamic relations to the organism. No one now doubts the importance of such studies in such large groups as the Ammonoid and Nautiloid cephalopods, the Volutidæ among gastropods, and the Naiades among pelecypods.

The study of the stages of evolution of the larval characteristics is a field hardly entered upon and promising rich returns to the student, and, for the paleontologist, deprived of all anatomical aid in tracing the lineage of peculiar extinct genera, the necessity of study of the nepionic stages of the fossils is fundamental.

For these reasons all contributions to our knowledge of existing larval forms are welcome, especially with such a wealth of illustration as in the present volume. Among the more important matters in it we find a very full account of *Janthina*, in both adult and larval states; of larvæ of the type of *Echinospira*, belonging to the Lamellariidæ; of the *Macgillivrayia* type like those of *Tritonium* and *Dolium;* of the *Sinusigera* type, including many genera of Rhachiglossa and Toxoglossa; a general discussion of the conditions of larval existence and their bearing on the characters developed; some account of pelagic nudibranchs, such as *Glaucus* and *Fiona;* a table showing the quantitative results of the dredging or towing nets; and a bibliography of literature consulted.

The only criticism which suggests itself is that it would be more convenient for those who have to use the book if the magnification of the figures was stated in units of the whole length, rather than merely indicated by the name and number of the objective used for the microscopic work.

W. H. Dall.

The Structure and Development of Mosses and Ferns. By Douglas Houghton Campbell, Ph.D., Professor of Botany in the Leland Stanford, Jr., University. 8vo. Pp. 544. London, Macmillan & Co. 1895.

The results of the long continued and patient work that Dr. Campbell has been publishing from time to time on the Pteridophytes have at last been brought together, with the results of a large amount of new work on the Hepaticæ and other Bryophytes, and the whole results in a large volume issued by the well-known publishers, Macmillan & Co., under the above attractive title.

The first thing to be noted as praiseworthy in the book is clearness and simplicity of expression, for while dealing with a recondite subject and using strictly technical terms, the book reads smoothly and is devoid of that stilted language that too frequently characterizes works of this nature. The logical arrangement of the matter follows closely on the simplicity of style and these two features are sufficient to recommend the work to the learner, for too many are repelled from many a fascinating subject by the nature of the language and the lack of a systematic arrangement of the matter.

But beyond these questions of form the subject-matter is fresh and direct from the hand of the laboratory worker. The studies on which the work is primarily based were made from American plants, many of them plants from the Pacific coast that have never before been studied from the developmental and morphological standpoint. Riccia hirta, Fimbriaria Californica, Porella Bolanderi, Anthoceros fusiformis, Ophioglossum pendulum (from Hawaii), Botrychium Virginianum and Marsilea vestita are only a few of the new plants that have been called in to contribute their life history for the verification and often modification of the work of Hoffmeister, Kny, Gœbel, Strasburger and others made on similar plants of central Europe. As one result of this new study, Dr. Campbell has given us a fresh supply of illustrations in place of the standard stock that has become threadbare from long usage in European and American text-books. If some of the illustrations are not quite so clear cut as some that have appeared in certain European publications of recent date, they more than make up for this in their freshness and accuracy for they represent exactly the conditions met with by the author and have not been filled in by the imagination, as is sometimes the case.

We are pleased to note that for the first time in any somewhat general treatise of botany the Hepaticæ have received something like their proper treatment, and their representative position as a highly important group from the standpoint of phylogeny is clearly stated at the outset and strikingly developed through the work. A fair estimate of their differentiation and highly probable antiquity is also well set forth.

Dr. Campbell regards the lowest Metzgeriaceæ, like Sphærocarpus, as the simplest plants of the entire group and considers that the other groups of the Hepaticæ were differentiated from the ancestors of some plant of this character before the development of the sporophyte had advanced so far as in present forms of that genus. He sets forth a most excellent answer to the remarkable position of Goebel regarding the status of Buxbaumia and contributes several new points bearing on the interrelationships of the various groups of the true mosses.

In classification Dr. Campbell does not depart widely from arrangements that have heretofore been set forth, in the Hepaticæ, for instance, following the lead of Schiffner. The position of Isoetes as the possible ancestor of the Angiosperms is perhaps the most divergent point presented in the classification.

Comparison of the work of others is well made, and wherever criticism occurs it is always in the friendly, urbane spirit that ought always to characterize workers in science; where conclusions are stated, they are couched in pointed and forcible language but never dogmatically. Altogether the work is a valuable contribution and will stand comparison with the best work of the kind that has been done anywhere.

L. M. UNDERWOOD.

Molecules and the Molecular Theory of Matter, by A. D. RISTEEN, S. B. Ginn & Co. Octavo, pp. 213.

This is an excellent resumé of the present state of our knowledge of the molecular theory, excluding most of the more difficult mathematical discussions, and including the principal conclusions of Clausius, Kelvin, Boltzmann, Maxwell and many others who have cultivated this department of physical science.

After some general considerations involving a presentation of the hypothesis of molecules and a definition of what is meant by a molecule, together with a brief statement of the assumed molecular constitution of solids, liquids and gases, the kinetic theory of gases is seriously taken up. The fundamental assumptions of the theory are discussed, Maxwell's Theorem is proved and the statistical method of treatment illustrated. The results of the kinetic theory are compared with the results of observation, and the chapter includes an examination of high vacua phenomena, the radiometer and other of Crookes' experiments.

The chapter on the Molecular Theory of Liquids includes, among other things, a fairly complete elementary study of surface tension and the phenomena of films. Chapter IV. is given to the Molecular Theory of Solids, concerning which there is really little known, but interesting studies of the phenomena of solution, diffusion, crystallization, etc., are here given. The concluding chapters on the Molecular Magnitude and the Constitution of Molecules are important and well done. The principal methods for determining molecular dimensions are gone into pretty thoroughly and the more recent hypothesis in regard to the constitution of the ether and the nature of matter are presented with great clearness and some fullness.

Among a few unimportant criticisms of the book that suggest themselves may be mentioned the holding on to the 'lecture' form of presentation. The foundation of the work was a lecture given by the author before the Washburn Engineering Society of the Worcester Polytechnic Institute, but it has been so expanded, and so much additional material has been supplied that it exceeds the limits of several lectures. As a large part of the new material is not in the lecture form and as little is gained by retaining it anyhow, it is to be regretted that the author did not reject it in the beginning.

As an echo of the discussion which occurred at the recent meeting at Springfield of the Society for the Promotion of Engineering Education, it may be well to note that on one or two pages this book illustrates the fatal results which are almost sure to follow the use of the formula W=mg, in the good old orthodox way. The author is lucky, however, in having apparently

followed Dr. Oliver Lodge who said that "The real rule on Engineers' principles would be to put 'g' somewhere into the expression for any quantity with which gravity has nothing to do, and to leave 'g' out whenever gravity is primarily concerned." By conscientiously adhering to this rule one may come out fairly well in the end, but in the present instance the confusion is more likely to be due to an oversight. On the whole the book will be a welcome addition to the library of any physicist who desires to avoid the necessity for much laborious research among original sources.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, DECEMBER.

THE principal article in this number of the Journal is one by C. F. Mabery on the composition of the Ohio and Canadian sulphur petroleums. In this article, which is only a partial report of the work, he reviews and discusses the work of other chemists in this field, and describes methods and forms of apparatus used in his investigations. As decomposition takes place in the distillation of crude petroleum during refining process, he could not use these products, but started with the crude oil and subjected it to fractional distillation *in vacuo*, in apparatus specially devised for this purpose. He found in the distillation of Ohio petroleum that no color or odor could be detected in the distillates below 235°; but above this point decomposition took place with evolution of hydrogen sulphide. The amount of ash left was small, and consisted chiefly of lime and magnesia, showing that the oil had dissolved some of the constituents of the rocks forming the cavities in which it was confined. A number of the lower-boiling hydrocarbons belonging to the methane series were isolated, and it was found that they were present in smaller quantities in the Ohio petroleum than in that from Pennsylvania.

Stillman and Yoder find that the compound formed by the action of anhydrous ammonia on aluminium chloride is $AlCl_3.6NH_3$. In their experiments dry air and ammonia were passed over aluminium chloride, and a partial decomposition of the product formed was always observed. The ammonia was partly oxidized, and water, aluminium oxide, and ammonium chloride formed.

Schlundt and Warder in an article, entitled, 'The Chemical Kinetics of Oxidation,' contribute some results on the speed of reactions under different circumstances. They find that the rate of liberation of iodine in a mixture of potassium chlorate, potassium iodide and hydrochloric acid is influenced by temperature, concentration and amount of excess of inorganic acid present.

L. W. McCay publishes a preliminary notice on the existence of the sulphoxyantimoniates. He finds that the salt prepared by Rammelsberg, and supposed by him to be a double salt, is potassium orthodisulphoxyantimoniate.

Freer gives the results of some experiments with tetrinic acid which are not in accord with the views of Nef and others on this subject. He finds that by the action of bromine on methylacetoacetic ester or its sodium salt, a uniform product is not obtained, but a mixture of four compounds. Two of these products are α- and γ- brommethylacetoacetic ester. From the latter tetrinic acid is easily formed; but, from the former, only in the presence of hydrobromic acid. There is a review in this number of 'The Principles and Practice of Agricultural Analysis' by H. W. Wiley, and obituary notices of Louis Pasteur and Felix Hoppe-Seyler.

J. ELLIOTT GILPIN.

NEW BOOKS.

Die Hausthiere. EDWARD HAHN. Leipzig, Duncker & Humblot. 1896. Pp. x+581.

Lecture Notes on Theoretical Chemistry. FERDINAND G. WEICHMANN. 2d edition. New York, John Wiley & Sons; London, Chapman & Hall, Lt'd. 1895. Pp. viii+288.

Manual of Lithology. EDWARD H. WILLIAMS. 2d edition. New York, John Wiley & Sons; London, Chapman & Hall, L't'd. 1895. Pp. 418.

Report of the Columbian Historical Exposition. Madrid, 1892; Washington, 1895. Pp. 411.

Lessons in Elementary Botany. THOMAS H. MACBRIDE. Allyn & Bacon, 1896. Pp. xi + 233. Introductory price, 60 cts.